VOLUME II

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APPENDIX A

Notice of Preparation

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NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT REPORT

TO: State Clearinghouse, Responsible and Trustee Agencies, and Other Interested Parties

DATE: September 3, 2014

SUBJECT: **Notice of Preparation of Environmental Impact Report**
Notice of EIR Scoping Meeting on September 22, 2014

LEAD AGENCY: City of East Palo Alto

PROJECT TITLE: East Palo Alto General Plan and Zoning Code Update

PROJECT AREA: City of East Palo Alto

Notice is hereby given that the City of East Palo Alto (the "City") will be the Lead Agency and will prepare a programmatic environmental impact report ("EIR") for the East Palo Alto General Plan and Zoning Code Update (the "Project"). The Project, its location, and potential environmental effects are described below. Pursuant to the CEQA Guidelines (14 C.C.R. § 15060(d)), the City has determined that an EIR is clearly required for the Project and as such an Initial Study will not be prepared and the City will begin work directly on the EIR.

The City is requesting comments and guidance on the scope and content of the EIR from interested public agencies, organizations and the general public. With respect to the views of Responsible and Trustee Agencies as to significant environmental issues, the City needs to know the reasonable alternatives and mitigation measures that are germane to each agency's statutory responsibilities in connection with the Project. Responsible agencies may need to use the EIR prepared by the City when considering permitting or other approvals for the Project.

We would appreciate your response at the earliest possible date; however due to time limits mandated by state law comments on the NOP are due no later than the close of the NOP review period on **October 3, 2014**. Please send your written comments to Anne Cook at the address shown below. Public agencies providing comments are asked to include a contact person for the agency.

An EIR scoping meeting will be held by the Planning Commission at its regularly scheduled meeting on:

September 22, 2014, 7:00 p.m.
East Palo Alto City Council Chambers
2415 University Avenue
East Palo Alto, CA 94303

Although the scoping meeting will provide an opportunity for the City to summarize the General Plan and Zoning Code Update process, **the focus of the scoping meeting will be on the EIR only.**

PROJECT TITLE: East Palo Alto General Plan and Zoning Code Update

LEAD AGENCY CONTACT:

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303
Telephone: 650-853-3142
Email: acook@cityofepa.org

INTRODUCTION:

The purpose of an EIR is to inform decision-makers and the general public of the environmental effects of a proposed project. The EIR process is intended to provide environmental information sufficient to evaluate a proposed project and its potential to cause significant effects on the environment; examine methods of reducing adverse environmental impacts; and consider alternatives to a proposed project.

The East Palo Alto General Plan and Zoning Code Update EIR will be prepared as a program EIR in accordance with the California Environmental Quality Act ("CEQA") and the CEQA Guidelines. The project location, project description, and the potential environmental effects that will be evaluated in the EIR are described generally below.

PROJECT LOCATION:

The project area consists of all lands within the jurisdictional limits of the City of East Palo Alto, all of which are considered the General Plan Planning Area. The City of East Palo Alto is located on the San Francisco Peninsula in the San Francisco Bay Area, in southeastern corner of San Mateo County. The City is bounded on the north and west by the city of Menlo Park, on the east by the San Francisco Bay, and on the south by the city of Palo Alto. Regional access to East Palo Alto is provided by U.S. Highway 101 and State Routes 84, 109 and 114. San Francisquito Creek runs along the south and west edges of the City and flows through the Baylands preserve into San Francisco Bay. East Palo Alto is primarily a residential community that also contains a regional shopping center and a major hotel and office complex along U.S. Highway 101, and other commercial, industrial and agricultural uses. **Figure 1** shows the Project location.

PROJECT DESCRIPTION:

The City of East Palo Alto is preparing a comprehensive update and revision to its 1999 General Plan and its Zoning Code which, together, will serve as a blueprint to guide the City's vision (also known as "Vista 2035") for its long-term land use and development through the year 2035. See www.vista2035.epa.org for more information.

There have been significant changes in East Palo Alto since the adoption of the 1999 General Plan, including substantial shifts in job and housing markets, demographics, and transportation and infrastructure needs. The General Plan Update process has therefore been designed to:

- Respond to socio-economic and demographic changes;
- Encourage community members to express their values and create a common vision for the City's future;
- Update policies for land use, community design, transportation, infrastructure, and quality of life, among others;
- Prioritize community health and equity;
- Include a chapter that provides focused policies for the Westside of the City to address major concerns there such as affordable housing, risk of flooding and infrastructure deficiencies.

Focus on Community Health - Like most general plan and zoning code updates, the Project will include a prioritized, progressive, and practical set of policy measures and implementation actions which will be addressed in separate sections or "elements" as required by State law (land use, circulation, housing, conservation, open space, noise and safety). Corresponding zoning code revisions and updates also will be made. Unlike many other general plan updates, however, the City of East Palo Alto will also include a specific focus on land use and planning goals and policies designed to positively affect the health and socio-economic well-being of the residents of East Palo Alto, who have long lagged behind other residents of San Mateo County on key indicators of public health and well-being. To this end, the City received a $1 million grant for the Project from the State's Strategic Growth Council. As a condition of that grant, the success of the Project will be measured in large part by how well it addresses key indicators of public health, over the life of the Project. Health-related issues and goals and policy measures that address them will be incorporated throughout the Plan.

Creating a safe and healthy community is a policy priority for the City of East Palo Alto, and will be a focus of *Vista2035*. There is increasing consensus that many aspects of the built environment – streets, buildings, parks, public space, and housing – influence the health of a community's residents. Planning for a healthy community therefore involves issues as seemingly diverse as land use, economics, transportation, air quality, parks, and demographics. Community health will be emphasized in the Project through a focus on a number of factors closely tied to health outcomes, including:

- Socioeconomic issues such as income, poverty, and educational attainment;
- Market issues such as unemployment, and the associated lack of health coverage;
- Community issues such as walkable neighborhoods, availability of healthy foods, and alcohol and liquor store densities;
- Safety issues such as pedestrian, bicycle, and automobile injuries and fatalities;
- Housing issues such as overcrowding, affordability, and homelessness;
- Open space issues such as proximity and access to parks; and
- Environmental issues such as air quality and respiratory health, water availability and quality, climate change, and noise pollution.

Land Use and Housing – Land use and housing policies also will be a major focus of the Project. Most of the City's sales tax generators are concentrated at the Ravenswood 101 shopping center, a freeway-accessible regional shopping center that includes large anchor stores like IKEA and Home Depot. The Project will consider options to re-envision this shopping center to meet the needs of the future, which could include additional land uses and increased densities. It will also consider additional residential, retail, and other commercial uses along the University Avenue corridor, and elsewhere in the City.

Although the City currently offers some of the most affordable housing in Silicon Valley, pressures on the housing market are continuing to push housing costs up. The City has long supported affordable housing within its boundaries. Updates to general plan policies are expected to include new and strengthen existing strategies for preserving affordability for existing residents, while also providing opportunities for new residential and mixed use development.

Transportation and Mobility – Transportation and mobility are also key planning factors that impact the health of communities. Specific issues that will be addressed as part of the Project include:

- Auto traffic: Heavy traffic volumes, congestion, and safety, especially on and around University Avenue and other roads that have become through-routes between Silicon Valley/Peninsula employment centers and major residential communities across the Dumbarton Bridge in the East Bay.

- Pedestrians: Sidewalks in East Palo Alto can be intermittent or in poor condition, complicating and discouraging pedestrian travel.

- Bicycles: Creating a city-wide bicycle network that overcomes major barriers, such as U.S. Highway 101. The rate of bicycle trips to work by City residents is four times the countywide average, so addressing gaps and barriers is of particular importance to the community.

- Increasing transit access and availability. While transit coverage is relatively extensive, most services are infrequent, even during peak times, and are somewhat more focused on through-travel than on serving the needs of local residents.

These discussions will be integrated throughout the General Plan Update so that the many and varied connections between General Plan topics and community health are considered. Community health cannot be treated as a stand-alone topic.

Zoning Code Update **–** The Project includes updates to the City's Zoning Ordinance to make zoning consistent with the General Plan Update as well as previously adopted City specific plans and ordinances. Updates to zoning will include the following topics, among others:

- General site planning and zoning standards, including site access requirements; fences, hedges, walls, and screening; noise regulations; outdoor lighting standards; performance standards (e.g., air quality, glare, vibration); and other topics determined to be appropriate by City staff.

- Affordable housing requirements, housing density bonus provisions, and related incentives, consistent with the City's Municipal Code and State law.

- Landscaping standards, including specific requirements for preliminary and final landscape plan submittal and review.

- Off-street parking and loading standards organized into user-friendly tables, including parking and loading area design, parking lot landscaping requirements, pedestrian circulation requirements, and bicycle and motorcycle parking.

- Sign standards organized into user-friendly tables with illustrative examples.

- Regulations that address standards for specific land uses that may include, but are not limited to, alcoholic beverage sales, child daycare facilities, home occupations, recycling areas, second dwelling units, wireless and telecommunications facilities, and other uses as directed by City staff.

- Updated City subdivision regulations (Title 16 - Subdivisions) to ensure full compliance with current California Subdivision Map Act requirements as interpreted by case law.

- Updated and refined design guidelines already adopted by the City's Planning Commission.

EIR ANALYSIS:

The EIR will evaluate the General Plan and Zoning Code Update for potential impacts on the environment and analyze proposed land use designations, urban design policies, and the environmental consequences of buildout of the General Plan planning area. The cumulative impacts discussion will consider relevant projects in and around the General Plan planning area that are not included as part of the Project.

CEQA requires that an EIR evaluate alternatives to a project that could reasonably attain the project objectives while reducing any significant impact of the project, as well as considering the "No Project Alternative".

POTENTIAL ENVIRONMENTAL EFFECTS OF THE PROJECT:

The EIR will assess the Project's potential direct, indirect, and cumulative environmental impacts on all environmental factors outlined in the CEQA Environmental Checklist (CEQA Guidelines, Appendix G) as follows:

- Aesthetics
- Agricultural and Forestry Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Geology/Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology/Water Quality
- Land Use/Planning
- Mineral Resources
- Noise
- Population/Housing
- Public Services
- Recreation
- Transportation/Traffic
- Utilities/Service Systems

Date: September 3, 2014

Signature: *Anne E. Cook*_______

Anne Cook
General Plan Project Manager
City of East Palo Alto

Figure 1 – Project Location

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APPENDIX A1

Comment Letters

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OFFICE OF THE CITY MANAGER

CITY OF PALO ALTO

250 Hamilton Avenue, 7th Floor
Palo Alto, CA 94301
650.329.2392

October 6, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto
Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303

Re: Comments on Notice of Preparation of Environmental Impact Report General Plan Update

Dear Ms. Cook:

Thank you for the providing the City of Palo Alto with the opportunity to review and comment on the Notice of Preparation (NOP) for the East Palo Alto General Plan Update Environmental Impact Report (EIR). We also greatly appreciate your agency's extension of the comment period. As a neighboring city, Palo Alto shares many interests with East Palo Alto. Among those interests are traffic, safety and flood control, as well as other impacts from development located near the East Palo Alto and Palo Alto borders. Evaluating the impacts of a comprehensive document such as General Plan can be complex, however, a strong public process for feedback can lead to a more robust planning process that will result in a stronger document.

The City is specifically concerned that the NOP does not provide sufficient information about the Westside Area Plan growth scenarios to permit us to comment effectively. The analysis of the growth scenarios is a critical component for the City of Palo Alto to understand not only the immediate effect, but also the area wide and long term impacts that would occur from adoption of the proposed Westside Area Plan. Palo Alto has a significant interest in the future of the Westside area due to its proximity to some of the City's residential neighborhoods and potential impact on the already stressed transportation network. Impacts are not always contained within the boundaries of one jurisdiction. A well-defined range for the growth scenarios must be carefully developed for a meaningful analysis in the EIR. Without a clearly identified range, it is not possible to provide the detailed comments or feedback needed to begin the EIR process. We would request that the growth scenarios be better defined before analysis is to begin.

We appreciate this opportunity to provide comments and for your consideration of our comments. If you have any questions regarding this letter, please contact Hillary Gitelman, Planning and Community Environment Director (or Elena Lee, Senior Planner) at (650) 329-2442 or email at Hillary.Gitelman@cityofpaloalto.org/Elena.Lee@cityofpaloalto.org.

Sincerely,

James Keene
City Manager

STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

PUBLIC UTILITIES COMMISSION
320 WEST 4TH STREET, SUITE 500
LOS ANGELES, CA 90013
(213) 576-7083

October 6, 2014

Anne Cook
City of East Palo Alto
1960 Tate Street
East Palo Alto, CA 94303

Dear Ms. Cook:

Re: SCH 2014092027 East Palo Alto (San Mateo) General Plan Update - NOP

The California Public Utilities Commission (Commission) has jurisdiction over the safety of highway-rail crossings (crossings) in California. The California Public Utilities Code requires Commission approval for the construction or alteration of crossings and grants the Commission exclusive power on the design, alteration, and closure of crossings in California. The Commission Rail Crossings Engineering Branch (RCEB) is in receipt of the *Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR)* from the State Clearinghouse for the proposed City of East Palo Alto (City) General Plan Update.

The project area includes the active rail tracks. RCEB recommends that the City add language to the General Plan Update so that any future development adjacent to or near the planned railroad right-of-way (ROW) is planned with the safety of the rail corridor in mind. New developments may increase traffic volumes not only on streets and at intersections, but also at any planned at-grade crossings. This includes considering pedestrian circulation patterns or destinations with respect to railroad ROW and compliance with the Americans with Disabilities Act. Mitigation measures to consider include, but are not limited to, the planning for grade separations for major thoroughfares, improvements to existing at-grade crossings due to increase in traffic volumes, and continuous vandal resistant fencing or other appropriate barriers to limit the access of trespassers onto the railroad ROW.

If you have any questions in this matter, please contact me at (213) 576-7076, ykc@cpuc.ca.gov.

Sincerely,

Ken Chiang, P.E., Utilities Engineer
Rail Crossings Engineering Branch
Safety and Enforcement Division

C: State Clearinghouse

ENVISION
TRANSFORM
BUILD
EPA

HOMEGROWN DESIGN FOR COMMUNITY
SELF-DETERMINATION

p. (650) 275-4ETB
EnvisionEPA@gmail.com

COORDINATING ORGANIZATIONS

El Comité de Vecinos

Youth United for Community Action

Peninsula Interfaith Action

Community Legal Services in East Palo Alto

Urban Habitat

ADVISORY MEMBERS

Carlos Romero

Community of East Palo Alto

LEAD CONTACT

Tameeka Bennett
Dr. Jennifer Martinez

October 3, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303

RE: Comments to the NOP of Environmental Impact Report For EPA General Plan and Zoning Code Update

Dear Mrs. Cook,

On behalf of Envision, Transform, Build – East Palo Alto Coalition, we are submitting the following comments to be considered for analysis/scope of the General Plan and Zoning Code Update for the City of East Palo Alto.

- We request an analysis of displacement impacts of renters on the Westside if new development is to occur there.
- The Westside chapter analysis should also focus of the affect of General Plan and Zoning code changes as they impact rent control and the provision of Affordable Housing.
- Given that community health will be emphasized in the Project through a number of factors closely tied to health outcomes we suggest that market issues related to housing demand and rental housing market dynamics be included within this context.
- The environmental and health impacts of overcrowding in housing due to rent pressures should be analyzed.
- Under the zoning code update analysis section, the EIR should look at impacts of any intensified housing uses, particularly on the West Side, and their impact on housing costs and upward rent pressures.
- The scope should include land value capture mechanisms to promote funds for development and preservation of affordable housing and how this might affect the socio-economic well-being of EPA residents.
- The scope should include an analysis of the impacts on rent controlled units should new residential development occur, particularly on the West Side.
- The cumulative impacts section of the General Plan EIR should discuss the future impacts of intensified housing and commercial development on the west side of 101 and the impacts of these activities on residential displacement of low-income residents (low-income as described for the City of East Palo Alto, not solely by San Mateo County standards).
- Potential commercial and offices use should be analyzed for their impact on the city's jobs/housing imbalance, particularly with respect to housing of low-income workers.

We are concerned that the full scope and impacts of the project may not be known at this time since the General Plan and its accompanying zoning changes are still being developed. We will comment on the Draft EIR when released and we will insist that unforeseen impacts, from growth in the scope of the project in the intervening months before the draft EIR is published, should be studied. Even if this means delaying the approval of the GP beyond the March 2016 project deadline.

If you have any questions, please do not hesitate to contact us at (650) 275-4ETB.

Sincerely,

Javanni Munguia-Brown, El Comite de Vecinos
Tameeka Bennett, YUCA
Daniel Saver, CLSEPA
Carlos Romero, ETB-EPA

WOODLAND CREEK HOMEOWNERS ASSOCIATION
Street Address: 1982 West Bayshore Road, East Palo Alto, CA 94303
Mailing Address: c/o CJM Association Services, Inc., P.O Box 190, Pleasanton, CA 94566

Via Email

October 3, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303
acook@cityofepa.org

RE: Notice of Preparation of Environmental Impact Report
East Palo Alto General Plan and Zoning Code Update

Dear Ms. Cook:

The Woodland Creek Homeowners Association (HOA) represents 90 residential homes located at 1982 West Bayshore Road, East Palo Alto, CA 94303 (Woodland Creek). The HOA's Board of Directors for the owners is writing to provide the following comments to the above-referenced Notice of Preparation (NOP) of the Environmental Impact Report (EIR) for the East Palo Alto General Plan and Zoning Code Update (Update).

1. We are concerned that the public is being asked to comment on the scope of the EIR for the Update when there is no draft of the Update available for us to review. Therefore, we are concerned that the NOP does not provide a meaningful opportunity for comment.[1] **We request that the City of East Palo Alto (City) as the Lead Agency provide another opportunity to provide scoping comments when the draft Update is available for review.**

2. We appreciate the City's commitment, as stated in the NOP, to assess the Update's "potential direct, indirect, and cumulative environmental impacts on **all environmental factors** outlined in the CEQA Environmental Checklist…" (emphasis added).

3. We are particularly interested in issues of traffic, parking, zoning, walkability, parks and open space (e.g., greenbelts), public transit, pedestrian & bicyclist safety, and environmental health (e.g., air quality). As we are on the border of San Francisquito Creek, we are also interested in protecting and enhancing the open-space and habitat value of this important resource.

4. Please note that East Palo Alto (EPA) residents travel by foot, bicycle, and car every day to adjoining communities. Safe interconnections are vital. **There is no sidewalk on West Bayshore Road between San Francisquito Bridge (where the EPA sidewalk ends) and**

[1] "An accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192-93: accord *San Joaquin Raptor/Wildlife Reserve Center v. County of Stanislaus* (1994) 27 Cal.App.4th 713, 730.) Such a project description "is necessary for an intelligent evaluation of the potential environmental effects of a proposed activity." (*McQueen v. Board of Directors of the Mid-Peninsula Regional Open Space District* (1988) 202 Cal.App.3d 1136, 1143.)

Channing Avenue (where the Palo Alto sidewalk begins). This gap is dangerous for pedestrians, bicyclists, and also motorists who often must swerve into oncoming traffic to avoid collisions. Therefore, we believe that the Update, and the EIR, should include/assess policies supporting safe interconnections with bordering communities, including West Bayshore Road.

5. Please note that, in our view, the programmatic EIR that will be prepared for the Update will not eliminate the need for project-specific CEQA review of the potential direct, indirect, and cumulative environmental impacts of the projects that may be proposed for the Westside. The Westside projects will directly affect our community. **Therefore, we will expect full CEQA review of all projects proposed for the Westside.**

6. Thank you for considering our comments. Please send all responses, notices, and other correspondence to:

Woodland Creek Homeowners Association
c/o CJM Association Services, Inc., P.O Box 190, Pleasanton, CA 94566
ATTN: Charlene Marquez <Char@cjmasi.com>

Sincerely,

Brenda Erwin
President, Board of Directors
Woodland Creek Homeowners Association

cc: Board of Directors, Woodland Creek Homeowners Association
CJM Association Services

Anne Cook

From: Emma Shlaes [emma@bikesiliconvalley.org]
Sent: Friday, October 03, 2014 3:00 PM
To: Anne Cook
Cc: Colin Heyne
Subject: SVBC Comments on East Palo Alto General Plan and Zoning Code Update

Dear Ms. Cook,

Thank you for the opportunity to comment on the scoping of the environmental impact report for the East Palo Alto General Plan and Zoning Code Update. Please accept the following comments.

1. The EIR should make specific strides to focus less on traffic congestion and its proxy level of service (LOS) as the focus of CEQA transportation analysis given the passage of State Senate Bill 743. The environmental analysis must be primarily evaluative to its promotion of "the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." The initial report cited a reduction of Vehicle Miles Traveled (VMT) as a replacement metric to evaluate transportation impacts and this should be considered.
2. In addition, VMT should be a key criterion for zoning: different zones should be situated to minimize VMT.
3. The Circulation Element should set transportation goals that support statewide carbon reduction goals, namely those in AB 32, the Global Warming Solutions Act of 2006, which set greenhouse gas emissions reductions targets for 2020 and SB 375, the Sustainable Communities and Climate Protection Act of 2008. This can be accomplished through strategies to reduce vehicle miles traveled and single-occupancy vehicle trips while increasing active transportation through bicycling, walking, and public transit.
4. A Complete Streets Policy is required by the State of California and the General Plan should reflect this commitment to complete streets implementation by ensuring that modes of travel other than cars are considered on city streets.

Let me know if you have any questions.

Sincerely,

Emma Shlaes

--
Emma Shlaes
Policy Manager
Silicon Valley Bicycle Coalition
96 N. Third Street, Suite 375
PO Box 1927
San Jose, CA 95109
Office: 408-287-7259 Ext. 228

Cell: 650-703-1191
http://bikesiliconvalley.org

Join us at our 7th Annual Dinner, October 17th

Anne Cook

From: Freeman, Craig [CFreeman@sfwater.org]
Sent: Thursday, October 02, 2014 5:32 PM
To: Anne Cook
Cc: Torrey, Irina; Wilson, Joanne
Subject: E Palo Alto General Plan & Zoning Code Update - Notice of Prep for EIR

Anne,

In response to the subject NOP, the San Francisco Public Utilities Commission would like to request that copies of the Notice of Availability for the DEIR are forwarded to the following individuals:

Joanne Wilson, SFPUC Natural Resources and Lands Management Division: jwilson@sfwater.org
Irina Torrey, SFPUC Bureau of Environmental Management: ITorrey@sfwater.org

Please let me know if you require a U.S. Mail (street) address for Joanne and Irina.

Thanks for your assistance.

Regards,
Craig

Craig Freeman
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 6th Floor
San Francisco, CA 94102
direct (415) 934-5740
main (415) 934-5700
cfreeman@sfwater.org
www.sfwater.org

SANTA CLARA
Valley Transportation Authority

October 1, 2014

City of East Palo Alto
Community Development Department
1960 Tate Street
East Palo Alto, CA 94303

Attention: Anne Cook

Subject: East Palo Alto General Plan and Zoning Code Update

Dear Ms. Cook:

Santa Clara Valley Transportation Authority (VTA) staff have reviewed the NOP for the East Palo Alto General Plan and Zoning Code Update. We have the following comments.

Bicycle Crossings
The NOP states that the General Plan will address "Creating a city-wide bicycle network that overcomes major barriers, such as U.S. Highway 101." There are several "across barrier connection" (ABC) improvements in Santa Clara County that would meet the City's goals and support VTA's Santa Clara Countywide Bicycle Plan, including the Adobe Creek Overcrossing, Matadero Creek Trail, and Oregon Expressway Pedestrian Overcrossing. VTA would be happy to work with the City of East Palo Alto to identify opportunities to implement these improvements.

Transportation Analysis – Relationship to Santa Clara County Congestion Management Program.
As the Congestion Management Agency for Santa Clara County, we recommend that the transportation analysis include an analysis of the effects of the General Plan Update on key roadway segments in the Santa Clara County CMP near the East Palo Alto border, such as US 101.

Thank you for the opportunity to review this project. If you have any questions, please call me at (408) 321-5784.

Sincerely,

Roy Molseed
Senior Environmental Planner

EPA1401

OFFICE OF THE CITY MANAGER

CITY OF
PALO
ALTO

250 Hamilton Avenue, 7th Floor
Palo Alto, CA 94301
650.329.2392

October 2, 2014

John Doughty
Community & Economic Development Department
City of East Palo Alto
1960 Tate Street
East Palo Alto, Ca 94303

Re: Response to City of EPA GP Update NOP

Dear Mr. Doughty,

I am forwarding you a copy of the Notice of Preparation of an EIR for the City of East Palo Alto staff report that will be presented to the Palo Alto City Council on Monday, October 6, 2014.

Feel free to contact me or my assistant Janice at 650-329-2105 with any questions you may have.

Best Regards,

James Keene
City Manager

CITY OF PALO ALTO

City of Palo Alto
City Council Staff Report

(ID # 5126)

Report Type: Consent Calendar **Meeting Date: 10/6/2014**

Summary Title: Response to City of EPA GP Update NOP

Title: Response to the Notice of Preparation of an Environmental Impact Report for the City of East Palo Alto General Plan Update

From: City Manager

Lead Department: Planning and Community Environment

Recommendation
Staff recommends that Council authorize the City Manager to submit comments in response to the Notice of Preparation of an Environmental Impact Report for the East Palo Alto General Plan Update.

Executive Summary
The City of East Palo Alto has issued a Notice of Preparation of a Programmatic Environment Impact Report for their General Plan Update (Attachment A). The Notice of Preparation does not contain sufficient information to allow for detailed comments, and staff believes the attached draft letter (Attachment B) will communicate this concern.

Background and Discussion
The City of East Palo Alto (EPA) began work in the fall of 2013 to update their General Plan. East Palo Alto has completed the preparation of an Existing Conditions Report and visioning exercises with the public. They are currently developing alternatives and policy changes.

An important component of the General Plan Update is the preparation of the Westside Area Plan, which will provide more detailed policy regulations for the area west of U.S Highway 101. This area borders Palo Alto and is adjacent to the Crescent Park and Duveneck-St. Francis neighborhoods. Accordingly, any changes proposed for this area plan would directly impact Palo Alto, and staff is concerned that the City of EPA's Notice of Preparation does not specify the changes that are being considered, even though the City of EPA has had public workshops where significant increases in density have been discussed. More information on the update process can be found on the project website http://vista2035epa.org.

In accordance with the California Environmental Quality Act (CEQA), the City of EPA issued a Notice of Preparation for a Programmatic Environmental Impact Report (EIR) on September 3,

2014. The close of the NOP comment period is October 3, 2014, however staff of East Palo Alto have agreed to extend the comment period to October 10, 2014 to allow for City Council review of the attached comment letter.

The most significant concern that Palo Alto may have with the East Palo Alto General Plan Update would be any proposed land use or policy changes for their Westside Area Plan. Because of the area's proximity to Palo Alto, any consideration of an increase in density or changes in use could have significant area-wide impacts. Staff will request that East Palo Alto better define the various growth scenarios that are being considered to allow for a clearer understanding of what potential impacts may be and what specific issues must be studied in the EIR.

Next Steps

Upon receiving authorization, the City Manager will submit an official comment letter to the City of East Palo Alto. Staff will also monitor East Palo Alto's planning process and follow up with their staff as needed. East Palo Alto planning staff has also been invited to present a project summary to the Palo Alto Planning and Transportation Commission later this fall. (Palo Alto planning staff has been invited to present a summary of the Comprehensive Plan Update to the East Palo Alto planning commission.)

Attachments:

- Attachment A: East Palo Alto General Plan Update Notice of Preparation of an EIR (PDF)
- Attachment B: Draft Comment Letter for EPA GP Update NOP (PDF)

NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT REPORT

TO:	State Clearinghouse, Responsible and Trustee Agencies, and Other Interested Parties
DATE:	September 3, 2014
SUBJECT:	**Notice of Preparation of Environmental Impact Report** **Notice of EIR Scoping Meeting on September 22, 2014**
LEAD AGENCY:	City of East Palo Alto
PROJECT TITLE:	East Palo Alto General Plan and Zoning Code Update
PROJECT AREA:	City of East Palo Alto

Notice is hereby given that the City of East Palo Alto (the "City") will be the Lead Agency and will prepare a programmatic environmental impact report ("EIR") for the East Palo Alto General Plan and Zoning Code Update (the "Project"). The Project, its location, and potential environmental effects are described below. Pursuant to the CEQA Guidelines (14 C.C.R. § 15060(d)), the City has determined that an EIR is clearly required for the Project and as such an Initial Study will not be prepared and the City will begin work directly on the EIR.

The City is requesting comments and guidance on the scope and content of the EIR from interested public agencies, organizations and the general public. With respect to the views of Responsible and Trustee Agencies as to significant environmental issues, the City needs to know the reasonable alternatives and mitigation measures that are germane to each agency's statutory responsibilities in connection with the Project. Responsible agencies may need to use the EIR prepared by the City when considering permitting or other approvals for the Project.

We would appreciate your response at the earliest possible date; however due to time limits mandated by state law comments on the NOP are due no later than the close of the NOP review period on **October 3, 2014**. Please send your written comments to Anne Cook at the address shown below. Public agencies providing comments are asked to include a contact person for the agency.

An EIR scoping meeting will be held by the Planning Commission at its regularly scheduled meeting on:

September 22, 2014, 7:00 p.m.
East Palo Alto City Council Chambers
2415 University Avenue
East Palo Alto, CA 94303

Although the scoping meeting will provide an opportunity for the City to summarize the General Plan and Zoning Code Update process, **the focus of the scoping meeting will be on the EIR only.** **PROJECT TITLE:** East Palo Alto General Plan and Zoning Code Update

LEAD AGENCY CONTACT:

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303
Telephone: 650-853-3142
Email: acook@cityofepa.org

INTRODUCTION:

The purpose of an EIR is to inform decision-makers and the general public of the environmental effects of a proposed project. The EIR process is intended to provide environmental information sufficient to evaluate a proposed project and its potential to cause significant effects on the environment; examine methods of reducing adverse environmental impacts; and consider alternatives to a proposed project.

The East Palo Alto General Plan and Zoning Code Update EIR will be prepared as a program EIR in accordance with the California Environmental Quality Act ("CEQA") and the CEQA Guidelines. The project location, project description, and the potential environmental effects that will be evaluated in the EIR are described generally below.

PROJECT LOCATION:

The project area consists of all lands within the jurisdictional limits of the City of East Palo Alto, all of which are considered the General Plan Planning Area. The City of East Palo Alto is located on the San Francisco Peninsula in the San Francisco Bay Area, in southeastern corner of San Mateo County. The City is bounded on the north and west by the city of Menlo Park, on the east by the San Francisco Bay, and on the south by the city of Palo Alto. Regional access to East Palo Alto is provided by U.S. Highway 101 and State Routes 84, 109 and 114. San Francisquito Creek runs along the south and west edges of the City and flows through the Baylands preserve into San Francisco Bay. East Palo Alto is primarily a residential community that also contains a regional shopping center and a major hotel and office complex along U.S. Highway 101, and other commercial, industrial and agricultural uses. **Figure 1** shows the Project location.

PROJECT DESCRIPTION:

The City of East Palo Alto is preparing a comprehensive update and revision to its 1999 General Plan and its Zoning Code[1] which, together, will serve as a blueprint to guide the City's vision (also known as "Vista 2035") for its long-term land use and development through the year 2035. See www.vista2035.epa.org for more information.

There have been significant changes in East Palo Alto since the adoption of the 1999 General Plan, including substantial shifts in job and housing markets, demographics, and transportation and infrastructure needs. The General Plan Update process has therefore been designed to:

- Respond to socio-economic and demographic changes;
- Encourage community members to express their values and create a common vision for the City's future;
- Update policies for land use, community design, transportation, infrastructure, and quality of life, among others;
- Prioritize community health and equity;
- Include a chapter that provides focused policies for the Westside of the City to address major concerns there such as affordable housing, risk of flooding and infrastructure deficiencies.

Focus on Community Health - Like most general plan and zoning code updates, the Project will include a prioritized, progressive, and practical set of policy measures and implementation actions which will be addressed in separate sections or "elements" as required by State law (land use, circulation, housing, conservation, open space, noise and safety). Corresponding zoning code revisions and updates also will be made. Unlike many other general plan updates, however, the City of East Palo Alto will also include a specific focus on land use and planning goals and policies designed to positively affect the health and socio-economic well-being of the residents of East Palo Alto, who have long lagged behind other residents of San Mateo County on key indicators of public health and well-being. To this end, the City received a $1 million grant for the Project from the State's Strategic Growth Council. As a condition of that grant, the success of the Project will be measured in large part by how well it addresses key indicators of public health, over the life of the Project. Health-related issues and goals and policy measures that address them will be incorporated throughout the Plan.

Creating a safe and healthy community is a policy priority for the City of East Palo Alto, and will be a focus of *Vista2035*. There is increasing consensus that many aspects of the built environment – streets, buildings, parks, public space, and housing – influence the health of a community's residents. Planning for a healthy community therefore involves issues as

[1] City of East Palo Alto Zoning Ordinance, Section 6100 et seq.

seemingly diverse as land use, economics, transportation, air quality, parks, and demographics. Community health will be emphasized in the Project through a focus on a number of factors closely tied to health outcomes, including:

- Socioeconomic issues such as income, poverty, and educational attainment;
- Market issues such as unemployment, and the associated lack of health coverage;
- Community issues such as walkable neighborhoods, availability of healthy foods, and alcohol and liquor store densities;
- Safety issues such as pedestrian, bicycle, and automobile injuries and fatalities;
- Housing issues such as overcrowding, affordability, and homelessness;
- Open space issues such as proximity and access to parks; and
- Environmental issues such as air quality and respiratory health, water availability and quality, climate change, and noise pollution.

Land Use and Housing – Land use and housing policies also will be a major focus of the Project. Most of the City's sales tax generators are concentrated at the Ravenswood 101 shopping center, a freeway-accessible regional shopping center that includes large anchor stores like IKEA and Home Depot. The Project will consider options to re-envision this shopping center to meet the needs of the future, which could include additional land uses and increased densities. It will also consider additional residential, retail, and other commercial uses along the University Avenue corridor, and elsewhere in the City.

Although the City currently offers some of the most affordable housing in Silicon Valley, pressures on the housing market are continuing to push housing costs up. The City has long supported affordable housing within its boundaries. Updates to general plan policies are expected to include new and strengthen existing strategies for preserving affordability for existing residents, while also providing opportunities for new residential and mixed use development.

Transportation and Mobility – Transportation and mobility are also key planning factors that impact the health of communities. Specific issues that will be addressed as part of the Project include:

- Auto traffic: Heavy traffic volumes, congestion, and safety, especially on and around University Avenue and other roads that have become through-routes between Silicon Valley/Peninsula employment centers and major residential communities across the Dumbarton Bridge in the East Bay.

- Pedestrians: Sidewalks in East Palo Alto can be intermittent or in poor condition, complicating and discouraging pedestrian travel.

- Bicycles: Creating a city-wide bicycle network that overcomes major barriers, such as U.S. Highway 101. The rate of bicycle trips to work by City residents is four times the countywide average, so addressing gaps and barriers is of particular importance to the community.

- Increasing transit access and availability. While transit coverage is relatively extensive, most services are infrequent, even during peak times, and are somewhat more focused on through-travel than on serving the needs of local residents.

These discussions will be integrated throughout the General Plan Update so that the many and varied connections between General Plan topics and community health are considered. Community health cannot be treated as a stand-alone topic.

Zoning Code Update – The Project includes updates to the City's Zoning Ordinance to make zoning consistent with the General Plan Update as well as previously adopted City specific plans and ordinances. Updates to zoning will include the following topics, among others:

- General site planning and zoning standards, including site access requirements; fences, hedges, walls, and screening; noise regulations; outdoor lighting standards; performance standards (e.g., air quality, glare, vibration); and other topics determined to be appropriate by City staff.

- Affordable housing requirements, housing density bonus provisions, and related incentives, consistent with the City's Municipal Code and State law.

- Landscaping standards, including specific requirements for preliminary and final landscape plan submittal and review.

- Off-street parking and loading standards organized into user-friendly tables, including parking and loading area design, parking lot landscaping requirements, pedestrian circulation requirements, and bicycle and motorcycle parking.

- Sign standards organized into user-friendly tables with illustrative examples.

- Regulations that address standards for specific land uses that may include, but are not limited to, alcoholic beverage sales, child daycare facilities, home occupations, recycling areas, second dwelling units, wireless and telecommunications facilities, and other uses as directed by City staff.

- Updated City subdivision regulations (Title 16 - Subdivisions) to ensure full compliance with current California Subdivision Map Act requirements as interpreted by case law.

- Updated and refined design guidelines already adopted by the City's Planning Commission.

EIR ANALYSIS:

The EIR will evaluate the General Plan and Zoning Code Update for potential impacts on the environment and analyze proposed land use designations, urban design policies, and the environmental consequences of buildout of the General Plan planning area. The cumulative impacts discussion will consider relevant projects in and around the General Plan planning area that are not included as part of the Project.

CEQA requires that an EIR evaluate alternatives to a project that could reasonably attain the project objectives while reducing any significant impact of the project, as well as considering the "No Project Alternative".

POTENTIAL ENVIRONMENTAL EFFECTS OF THE PROJECT:

The EIR will assess the Project's potential direct, indirect, and cumulative environmental impacts on all environmental factors outlined in the CEQA Environmental Checklist (CEQA Guidelines, Appendix G) as follows:

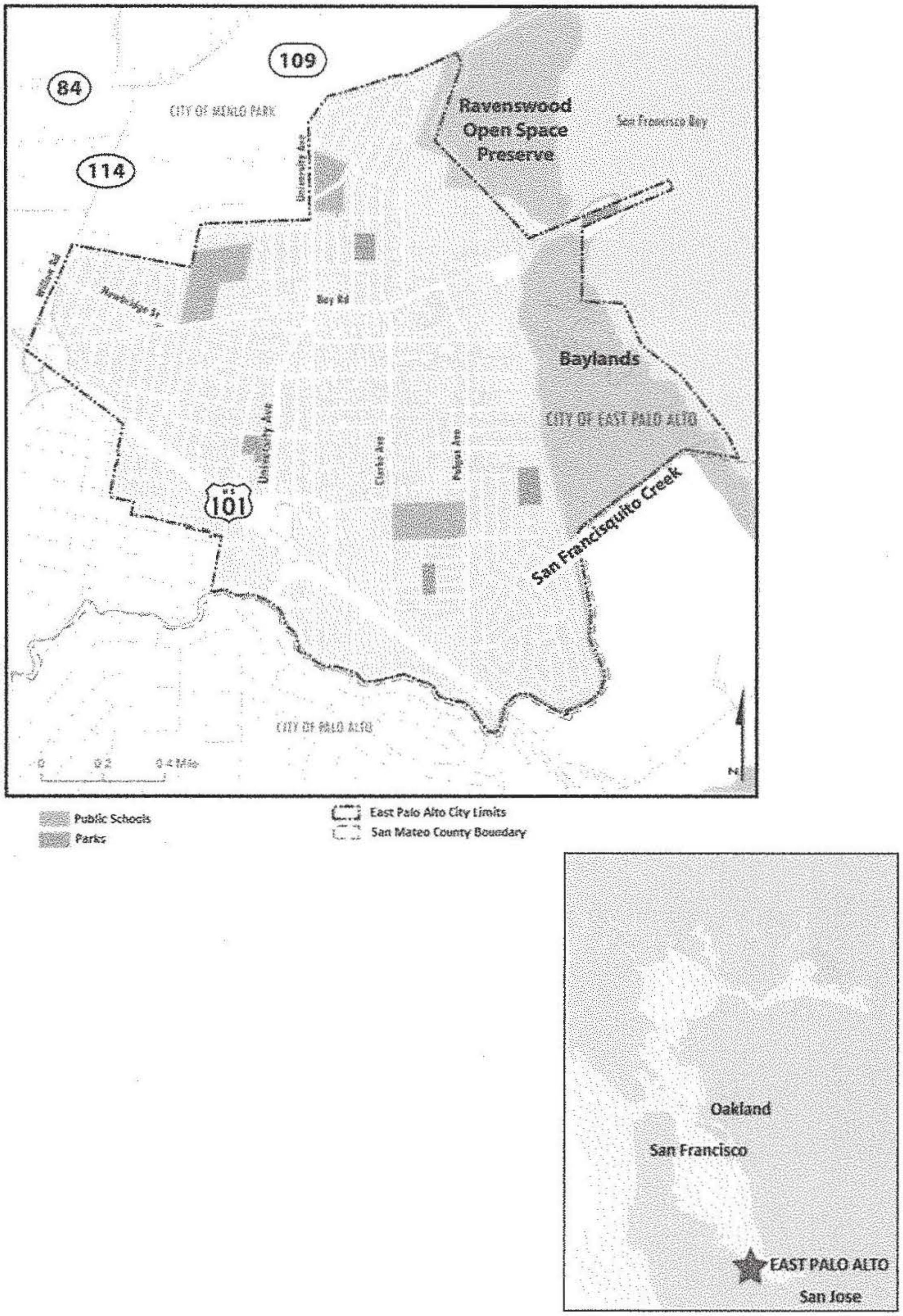
- Aesthetics
- Agricultural and Forestry Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Geology/Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology/Water Quality
- Land Use/Planning
- Mineral Resources
- Noise
- Population/Housing
- Public Services
- Recreation
- Transportation/Traffic
- Utilities/Service Systems

Date: September 3, 2014

Signature: *Anne E. Cook*

Anne Cook
General Plan Project Manager
City of East Palo Alto

Figure 1 – Project Location



ATTACHMENT B
(DRAFT)

OFFICE OF THE CITY MANAGER

CITY OF PALO ALTO

250 Hamilton Avenue, 7th Floor
Palo Alto, CA 94301
650.329.2392

October 6, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto
Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303

Re: Comments on Notice of Preparation of Environmental Impact Report General Plan Update

Dear Ms. Cook:

Thank you for the providing the City of Palo Alto with the opportunity to review and comment on the Notice of Preparation (NOP) for the East Palo Alto General Plan Update Environmental Impact Report (EIR). We also greatly appreciate your agency's extension of the comment period. As a neighboring city, Palo Alto shares many interests with East Palo Alto. Among those interests are traffic, safety and flood control, as well as other impacts from development located near the East Palo Alto and Palo Alto borders. Evaluating the impacts of a comprehensive document such as General Plan can be complex, and, a strong public process for feedback can lead to a more robust planning process that will result in a stronger document.

The City is specifically concerned that the NOP does not provide sufficient information about the Westside Area Plan growth scenarios to permit us to comment effectively. The analysis of the growth scenarios is a critical component for the City of Palo Alto to understand not only the immediate effect, but also the area wide and long term impacts that would occur from adoption of the proposed Westside Area Plan. Palo Alto has a significant interest in the future of the Westside area due to its proximity to some of the City's residential neighborhoods and potential impact on the already stressed transportation network. Impacts are not always contained within the boundaries of one jurisdiction. A well-defined range for the growth scenarios must be carefully developed for a meaningful analysis in the EIR. Without a clearly identified range, it is not possible to provide the detailed comments or feedback needed to begin the EIR process. We would request that the growth scenarios be better defined before analysis is to begin. You should expect that our community will have significant concerns about increased density and its impacts.

We appreciate this opportunity to provide comments and for your consideration of our comments. If you have any questions regarding this letter, please contact Hillary Gitelman, Planning and Community Environment Director or Elena Lee, Senior Planner at (650) 617-3196 or email at Elena.Lee@cityofpaloalto.org.

Sincerely,

James Keene

City Manager

cc: City Council
Hillary Gitelman, Director of Planning and Community Environment
Molly Stump, City Attorney
Elena Lee, Senior Planner

San Francisco Bay Conservation and Development Commission
455 Golden Gate Avenue, Suite 10600, San Francisco, California 94102 tel 415 352 3600 fax 415 352 3606

October 1, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303

SUBJECT: BCDC Inquiry File No. SM.MP.7232.2, Notice of Preparation (NOP) of Environmental Impact Report (EIR) for the City of East Palo Alto, Vista 2035 General Plan and Zoning Code Update.

Dear Ms. Cook:

Thank you for the opportunity to comment on the Notice of Preparation (NOP) for the Vista 2035 General Plan draft Environmental Impact Report (EIR). The NOP is dated September 3, 2014 and was received in our office on September 5, 2014. The Commission has not reviewed the NOP, so the following staff comments are based on the San Francisco Bay Plan (Bay Plan) and the McAteer-Petris Act and staff review of the NOP.

Jurisdiction and Land Use As a permitting authority along the San Francisco Bay shoreline, BCDC is responsible for granting or denying permits for any proposed fill (earth or any other substance or material, including pilings or structures placed on pilings, and floating structures moored for extended periods); extraction of materials; or change in use of any water, land or structure within the Commission's jurisdiction. Generally, BCDC's jurisdiction over San Francisco Bay extends over Bay tidal areas up to the mean high tide level, including all sloughs, and in marshlands up to five feet above mean sea level; a shoreline band consisting of territory located between the shoreline of the Bay and 100 feet landward and parallel to the shoreline; salt ponds; managed wetlands; and certain waterways tributary to the Bay. If a project is proposed within the Commission's jurisdiction, it must be authorized by the Commission pursuant to a BCDC permit, and the Commission will use the policies of the McAteer-Petris Act and the *San Francisco Bay Plan* (Bay Plan) to evaluate the project.

The map provided with the NOP shows the city limits of East Palo Alto as located along San Francisquito creek to the southwest, encompassing the tidal marsh baylands, a designated wildlife refuge, to the west with a section extending into the Bay at Cooley Landing Park, and then tucked along the Bay Trail next to, but not including, the Ravenswood Open Space Preserve. Much of the area along the city's southern and eastern shorelines are subject to Bay tidal influences; as such, the adjoining areas described above are within the Commission's shoreline band jurisdiction. If the General

Plan will include land use changes in these Bay shoreline areas or within the Bay, these should be discussed in the environmental document, including any environmental effects that may occur as a result, including any in or affecting sensitive habitat areas.

The baylands area within the city limits is a designated wildlife refuge area, a priority use, as shown in the Bay Plan on Maps No. 6 and 7. This priority use designation should be discussed in the environmental document (EIR) and whether any City proposed land uses would be consistent with this designation or surrounding areas. The Commission uses its Bay Plan Tidal Marshes and Tidal Flats, and Fish, Wildlife and Other Aquatic Organisms policies to determine consistency of proposals for wildlife priority use areas, and its Bay Plan recreation policies for assessing consistency of proposals with its waterfront park priority use designations.

Bay Fill. Section 66605 of the McAteer-Petris Act states that fill in San Francisco Bay should only be authorized when: (1) the public benefits from the fill clearly exceed the public detriment from the loss of water area and should be limited to water-oriented uses (such as ports, water-related industry, airports, bridges, wildlife refuges, water-oriented recreation and public assembly)... or minor fill for improving shoreline appearance or public access to the Bay; (2) no upland alternative location is available for the project purpose; (3) the fill is the minimum amount necessary to achieve the purpose of the fill; (4) the nature, location and extent of any fill will minimize harmful effects to the Bay; and (5) that the fill should be constructed in accordance with sound safety standards. If the proposed project would involve fill in the Bay, the project proponent will need to show that fill associated with the project meets all of the above listed criteria. While the NOP does not specify plans to place fill in the Bay, we ask that the draft EIR evaluate any proposed fill in light of the Commission's law.

Climate Change. Any development in the portions of the project area that are within BCDC's jurisdiction would be subject to the Climate Change policies of the Bay Plan. These policies state, in part, that: "*When planning shoreline areas or designing larger shoreline project, a risk assessment should be prepared by a qualified engineer and should be based on the estimated 100-year flood elevation that takes into account the best estimates of future sea level rise and current flood protection and planned flood protection that will be funded and constructed when needed to provide protection for the proposed project or shoreline area... To protect public safety and ecosystem services, within areas that a risk assessment determines are vulnerable to future shoreline flooding that threatens public safety, all projects – other than repairs of existing facilities, small projects that do not increase risks to public safety, interim projects and infill projects within existing urbanized areas – should be designed to be resilient to a mid-century sea level rise projection... undeveloped areas that are both vulnerable to future flooding and currently sustain significant habitats or species... should be given special consideration for preservation and habitat enhancement and should be encouraged to be used for those purposes.*"

It appears that significant areas within the plan area and along the adjacent shoreline may be vulnerable to projected sea level rise, and more immediate risks of flooding now and in the future. The general plan process is an opportunity for the City of East Palo Alto to evaluate the communities' future in light of more recent scientific data on sea level rise and to update plans to address community resilience, given projected sea level rise. As a planning tool, the preparers of the EIR may wish to refer to the Sea Level Rise and Coastal Flooding Impacts Viewer developed by NOAA Coastal Services Center in collaboration with a number of other agencies and organizations. The viewer is available at: http://www.csc.noaa.gov/digitalcoast/tools/slrviewer/. The draft EIR should discuss the potential for inundation and its impacts on land use, transportation, hydrology, water quality, hazards, infrastructure, utilities, and public services, and whether any improvements within the Commission's jurisdiction would be consistent with the Bay Plan Climate Change policies.

The draft EIR should include an analysis of how an increase in sea level under multiple sea level rise scenarios could impact low-lying shoreline areas. This should include information on (1) current shoreline elevations and vertical land motion (e.g., subsidence or uplift); (2) current rates of sedimentation, if known; (3) projected changes in wetland communities given sea level rise (this should also include information on surrounding areas); (4) projected hydraulic changes that would result in a change in tidal heights, duration of ponding, drainage, erosion, or sedimentation; and (5) the condition of existing shoreline protection.

Public Access. Section 66602 of the McAteer-Petris Act states, in part, that "*existing public access to the shoreline and waters of the San Francisco Bay is inadequate and that maximum feasible public access, consistent with a proposed project, should be provided.*" Furthermore, the McAteer-Petris Act authorizes the placement of fill in the Bay only for water-oriented uses or minor fill for improving shoreline appearance or public access.

If any projects identified in the NOP are within BCDC's jurisdiction, then the EIR should consider the Bay Plan policies on public access requirements which state, in part, that, "*in addition to the public access to the Bay provided by waterfront parks, beaches, marinas, and fishing piers, maximum feasible access to and along the waterfront and on any permitted fills should be provided in and through every new development in the Bay or on the shoreline... Whenever public access to the Bay is provided as a condition of development, on fill or on the shoreline, the access should be permanently guaranteed... Public access improvements provided as a condition of any approval should be consistent with the project and the physical environment, including protection of Bay natural resources, such as aquatic life, wildlife and plant communities, and provide for the public's safety and convenience. The improvements should be designed and built to encourage diverse Bay-related activities and movement to and along the shoreline, should permit barrier free access for persons with disabilities to the maximum feasible* *extent, should include an ongoing maintenance program, and should be identified with signs... Access to the waterfront should be provided by walkways, trails, or other appropriate means and connect to the nearest public thoroughfare where convenient parking or public transportation may be available..."*

All efforts to increase or include public access must be compatible with the wildlife and habitats of the area. As such, the policies further state that, *"public access to some natural areas should be provided to permit study and enjoyment of these areas. However, some wildlife are sensitive to human intrusion ... public access should be sited, designed and managed to prevent significant adverse effects on wildlife..."* The EIR should include an analysis of the impacts of any proposed shoreline development on public access and whether maximum feasible public access that could be provided as part of any project to be consistent with the Commission's policies on public access. Additionally, the EIR should evaluate the potential impacts of any proposed public access on sensitive wildlife species and habitats.

Recreation. The Bay Plan policies on recreation state, in part, that *"Diverse and accessible water-oriented recreational facilities, such as marinas, launch ramps, beaches, and fishing piers, should be provided to meet the needs of a growing and diversifying population, and should be well distributed around the Bay and improved to accommodate a broad range of water-oriented recreational activities for people of all races, cultures, ages and income levels... and Waterfront land needed for parks and beaches to meet future needs should be reserved now."*

The Bay Plan Maps 6 and 7 designate the levee trails in the Palo Alto-owned areas of the Bay shoreline in East Palo Alto to ensure that sufficient lands are reserved for important water-oriented uses, such as wildlife refuges, waterfront parks or beaches. The general plan and EIR should discuss whether the proposed uses or projects within the Commission's jurisdiction are consistent with the applicable Bay Plan and MPA policies. Currently, Cooley's Landing Park and the area around the Bay Trail have been designated "parks and recreation". We request that these designations remain in place for current and future use and enjoyment. Furthermore, please ensure that the authorizations and requirements set forth in BCDC Permit No. M2011.002.01 for Cooley Landing are reflected and adhered to in the course of your project.

While the City of Palo Alto currently has one designated trailhead site for the San Francisco Bay Area Water Trail (Water Trail), the City of East Palo Alto does not currently have any designated Water Trail sites. The City of East Palo Alto should consider including Water Trail sites along its shoreline where appropriate, such as at Cooley Landing. For more information regarding the San Francisco Bay Area Water Trail, please go to: http://sfbaywatertrail.org.

Bay Trail and Transportation. The Bay Plan policies on transportation state, in part, that "*Transportation projects... should include pedestrian and bicycle paths that will either be a part of the Bay Trail or connect the Bay Trail with other regional and community trails.*" The City of East Palo Alto contains sections of existing Bay Trail that extend from Menlo Park to Palo Alto. The EIR should discuss how this network of trails could be connected and integrated with the further development of trails, parks and open space within the proposed project area.

Water Quality. The Bay Plan policies on water quality state that, "*new projects should be sited, designed, constructed and maintained to prevent, or if prevention is infeasible, to minimize the discharge of pollutants to the Bay ....* " Additionally, in order to protect the Bay from the water quality impacts of nonpoint source pollution, "*new development should be sited and designed consistent with standards in municipal storm water permits and state and regional storm water management guidelines .... To offset the impacts from increased impervious areas and land disturbances, vegetated swales, permeable pavement materials, preservation of existing trees and vegetation, planting native vegetation and other appropriate measures should be evaluated and implemented where appropriate....*" The draft EIR should evaluate the potential impacts of the proposed projects to be included in the General Plan update on the water quality of the Bay and should propose best management practices and mitigation measures to minimize adverse impacts to water quality.

Appearance, Design, and Scenic Views. The Bay Plan policies on appearance, design, and scenic views state, in part, that "*all bayfront development should be designed to enhance the pleasure of the user or viewer of the Bay. Maximum efforts should be made to provide, enhance or preserve views of the Bay and shoreline, especially from public areas... Shoreline developments should be built in clusters, leaving open area around them to permit more frequent views of the Bay... Views of the Bay from... roads should be maintained by appropriate arrangements and heights of all developments and landscaping between the view areas and the water.*" The EIR should discuss the effect, if any, that the project would have on public views of the Bay.

We appreciate the opportunity to comment on the NOP for the EIR for the City Of East Palo Alto, Vista 2035 General Plan and Zoning Code update. If you have any questions or concerns regarding this matter, please do not hesitate to contact me at (415) 352-3641 or by email at codya@bcdc.ca.gov.

Sincerely,

Cody Aichele

CODY AICHELE
Coastal Planner

cc: State Clearinghouse

SFOP/PIA

A BAY AREA *for* ALL

September 22, 2014

East Palo Alto General Plan Consultants

To Whom It May Concern:

We are writing to express our interest in the Environmental Impact Review for the East Palo Alto General Plan update. For the past three years, the Peninsula Interfaith Action Organizing Committee at St. Francis of Assisi Catholic Church (XX) has been working on the issue of legalizing garage conversions and second units in East Palo Alto. We have had hundreds of people participating in the process, filling out surveys, going to action events and attending city council meetings.

Earlier this year, the City Council approved an ordinance to allow permanent garage conversions for houses that have a parcel size of 5500 sq ft or above. We had been working to get that policy to include all houses at **5000 sq ft** and above (the majority of East Palo Alto houses). In addition, our community wanted the council to allow second units ("granny houses") to have kitchens and bathrooms.

The City Council did not approve permanent garage conversions on 5000 sq ft lots or full second units because they wanted to see an environmental impact review of those potential changes. We now come to you asking you to include those elements in your study.

Undoubtedly, there will be many competing priorities for the environmental impact review, all with the interest of improving our community. We, too, want to make our community a place where families can more easily live and thrive, where streets are safe, and traffic and environmental hazards are reduced. We also know that most houses in our city already have garage conversions and second units, and by not legalizing them, families are plagued with housing insecurity and, as a city, we are not able to deal with the externalities, such as overcrowded parking on streets, impacts on our water resources and other essential services.

We encourage you to include in your study the impacts of legalizing full garage conversions and second units on 5000 sq ft lots.

Thank you for your consideration,

The St. Francis of Assisi Local Organizing Committee of SFOP/PIA (see undersigned)

San Francisco
Water Power Sewer
Operator of the Hetch Hetchy Regional Water System

Natural Resources and Lands Management
525 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
T 415.554.3265
F 415.934.5770

October 17, 2014

East Palo Alto General Plan and Zoning Code Update

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department
1960 Tate Street
East Palo Alto, CA 94303

Dear Ms. Cook,

Thank you for providing the Notice of Preparation of an Environmental Impact Report (EIR) for the East Palo Alto General Plan and Zoning Code Update. To assist in the preparation of the EIR, I am providing the following information regarding the SFPUC's Hetch Hetchy Regional Water System.

The SFPUC manages land and water system infrastructure owned by the City and County of San Francisco in and adjacent to the City of East Palo Alto as part of the Hetch Hetchy Regional Water System. The SFPUC provides drinking water to 2.6 million people in the San Francisco Bay Area. The SFPUC-owned land is located to the north of East Palo Alto, from the pipeline caissons and runs approximately parallel to the Dumbarton Bridge/Highway 84 before entering the City of East Palo Alto. Our lands, pipelines, right-of-way and infrastructure continue from the northern portion of East Palo Alto to the west side of East Palo Alto. The operation and maintenance of this water utility land and infrastructure should be included in the discussion of existing land uses, as well as the analysis of potential impacts of the proposed project on utilities and public services.

For your information, I am enclosing the SFPUC ROW Encroachment Policy, Draft Recreational Use Policy for SFPUC Water Pipeline Right-of-Way, and SFPUC Integrated Vegetation Management Policy.

Finally, please add me as a recipient of the upcoming draft EIR, as well as the following staff:

Rosanna Russell
Real Estate Director
RSRussell@sfwater.org
(415) 487-5213

Jonathan S. Mendoza
Land and Resources Planner
JSMendoza@sfwater.org
(650) 652-3215

Thank you.

Sincerely,

Tim Ramirez
Division Manager, Water Enterprise

Attachments:
SFPUC ROW Encroachment Policy
Draft Recreational Use Policy for SFPUC Water Pipeline Right of Way
SFPUC Integrated Vegetation Management Policy

SFPUC RIGHT OF WAY ENCROACHMENT POLICY
2007

As part of its utility system, the San Francisco Public Utilities Commission (SFPUC) operates and maintains approximately 1600 miles of water pipelines and tunnels, 160 miles of electrical transmission lines, 900 miles of sewer lines and other related appurtenances that run through real property (the "Right of Way") located in San Francisco, San Mateo, Santa Clara, Alameda, Tuolumne, Stanislaus and San Joaquin counties. Most of the Right of Way is owned by the City and County of San Francisco (the "City") in fee, although in some instances the City has only an easement interest for its right of way. Inside the City, most water and wastewater transmission lines are located within City streets.

Regardless of the nature of the City's property rights, it is vitally important that the SFPUC protect its water, wastewater, and power transmission facilities and ensure immediate access to all facilities for maintenance, repair, security and replacement. It is also important that the right of way be maintained so as to minimize any potential landowner liability and to prepare for the possibility of future capital improvements to the right of way.

Increased urbanization and development around the water transmission line right of way in particular has led to an increase in the number of encroachments onto the right of way. Water transmission pipelines are those that move water to SFPUC's wholesale customers located in Alameda, Santa Clara, San Mateo and to the City of San Francisco. These encroachments threaten access, impair new construction and maintenance efforts, and increase costs and potential liabilities. Houses, garages, driveways, fences, trees, landscaped areas, vehicles and other items currently encroach onto the right of way. The SFPUC has also noticed an increase in unauthorized uses such as temporary trespasses and garbage dumping. Therefore, on September 28, 1999, the San Francisco Public Utilities Commission adopted a Commercial Land Management Operating Manual that included a Right of Way (R/W) Encroachment Removal Policy published 12/14/01 and a R/W Vegetation Management Plan administered under the (R/W) Integrated Vegetation Management Policy attached hereto.

Since the original implementation of the R/W Encroachment Policy, security concerns have given additional impetus to the need to provide a safe and protected corridor for water transmission by the SFPUC. The SFPUC's concern for safety and security provides an additional foundation for the strict implementation of this policy.

Because of the length of the right of way and the importance of the encroachment removal effort, the SFPUC has determined that **intensified encroachment removal activities must commence** notwithstanding the failure to identify each and every encroachment. Accordingly, continuing identification, prevention and removal efforts shall occur simultaneously. In addition, due to limited resources and the variation in safety and other threats posed by different encroachments, the SFPUC shall continuously prioritize known encroachments to ensure that the encroachments that pose the greatest threat to pipeline access, construction, safety and security, and encroachments that can be easily removed are addressed first. Removal efforts shall initially focus on any encroachments which would:

(1) **endanger the existing or proposed water, sewer or electrical transmission lines and appurtenances;**

(2) **impair access to facilities for emergency repair, maintenance, or operational activity;**

(3) **be detrimental to the efficient and effective maintenance of the right of way;**

(4) **cause obstruction to the inspection and monitoring of equipment, and collection of land survey, corrosion control, and water quality data; and/or**

(5) **increase liabilities to the SFPUC. It shall be the policy of the SFPUC to take any and all necessary actions to cause the removal of, or to remove, such encroachments from the right of way in accordance with this policy.**

To prevent the unauthorized use of the right of way, the SFPUC **may install fences and other barriers where prudent** or necessary as authorized by the Water Enterprise Assistant General Manager after consultation with Real Estate Services (RES). The SFPUC's goal shall be to fence as much of the right of way as is necessary to protect the SFPUC's facilities and property rights. Said fencing shall be consistent with the SFPUC's standards at the time of fence installation. The Water Enterprise, working with RES, shall have broad discretion and authority to cause the installation of fences or other barriers along the right of way in any location deemed necessary or prudent.

Ancillary uses and encroachments in the right of way may be permitted only where the uses provide identifiable benefits to the SFPUC, as determined by SFPUC Water Enterprise and RES personnel. Approval of permitted uses shall be consistent with existing SFPUC policy and shall be processed by RES.

In specific cases, the SFPUC will allow use of the right of way by third parties in order to enhance maintenance efforts and reduce maintenance costs by the SFPUC. **For example, the SFPUC provides for the leasing or permitting of portions of the right of way with nominal revenue-generating potential**

to property owners whose land is bi-sected by the SFPUC right of way, neighborhood associations, municipal governmental entities, non-profit groups and similar entities at little or no cost, provided they agree to maintain the surface of the right of way in a good and safe condition acceptable to the SFPUC and to indemnify the SFPUC for any injury or loss relating to such third-party use. It is contemplated that this effort will focus on non-commercial uses such as parks and recreation areas. Only portions of the right of way large enough to reduce the SFPUC's maintenance costs and efforts shall be considered in this regard. In areas where the right of way may be leased to private entities for parking or other commercial uses, this shall be a preferred use due to its revenue-generating capacity. All such third party rights in SFPUC property will be temporary in nature.

Policy Implementation

SFPUC RES staff will use available resources to identify and prioritize all existing unauthorized encroachments and uses. With regard to each encroachment, SFPUC RES staff will gather relevant, available information. Where any current use of right of way property is not permitted, SFPUC Water Enterprise personnel will contact RES and obtain ownership information of the encroaching party and survey information of the encroachment, if necessary. The SFPUC RES staff will notify the adjacent owner/encroacher that the use is not authorized, and such notice will identify the option or options available to the adjacent property owners/encroachers, consistent with an administrative procedure, acceptable to the SFPUC General Manager, to be prepared and implemented by RES. Depending on the nature of the encroachment, and at the sole discretion of the SFPUC, **options may include:**

(1) immediate removal;

(2) removal within a specified period of time;

(3) possible modifications to the encroachment; and/or

(4) development of a permit agreement with provisions acceptable to the SFPUC.

The administrative procedures will include attempts to resolve the encroachment through follow-up contact with the adjacent property owners/encroachers by RES. RES shall establish and chair an Internal Encroachment Review Committee (IERC) for the purpose of providing an administrative review of and proposed resolution to encroachments that may not be resolved via initial contacts between the SFPUC and the adjacent property owners/encroachers. Should administrative procedures fail or reach impasse, the SFPUC will, working with the City Attorneys'

Office, avail itself of any available remedies, including but not limited to self-help remedies and/or litigation. In particular, where the encroachment consists of trees or vegetation, or the owner of the encroachment is unknown, SFPUC RES staff may determine to cause the removal of the encroachment following notice (posting and/or mail) of the date set for removal without first requesting that the removal be performed by adjoining property owners. The SFPUC RES staff will make every effort to recover the costs of such removal from the adjacent property owners/encroachers.

For Areas that Should be Fenced as Determined by the SFPUC Water Enterprise:

1. Staff from RES will gather relevant, available information to confirm the location of the applicable SFPUC property boundaries.

2. Staff from SFPUC Communications Group will notify neighboring property owners in advance, of the SFPUC Water Enterprise's decision to install fences in the specified areas.

3. The SFPUC Water Enterprise will cause the fence or other barrier to be installed in the specified locations at the times specified in the notice above.

Hetch Hetchy
Regional Water System
Services of the San Francisco Public Utilities Commission

Proposed Amendment To
2013 Real Estate Guidelines:

Draft Recreational Use Policy for
SFPUC Water Pipeline Right of Way
in San Mateo, Santa Clara, and Alameda Counties

September 8, 2014

Draft Recreational Use Policy for SFPUC Water Pipeline Right of Way in San Mateo, Santa Clara, and Alameda Counties

As part of its utility system, the San Francisco Public Utilities Commission (SFPUC) operates and maintains hundreds of miles of water pipelines. The SFPUC provides for limited public recreational use on its water pipeline property or right of way (ROW) throughout Alameda, Santa Clara, and San Mateo counties. The following controls will help inform how and in which instances the ROW can serve the needs of third parties—including public agencies, private parties, nonprofit organizations, and developers—seeking to provide recreational opportunities to local communities.

Primarily, SFPUC land is used to deliver high quality, efficient and reliable water, power, and sewer services in a manner that is inclusive of environmental and community interests, and that sustains the resources entrusted to our care. The SFPUC's utmost priority is maintaining the safety and security of the pipelines that run underneath the ROW.

Through our formal Project Review and Land Use Application and Project Review process, we may permit a secondary use on the ROW if it benefits the SFPUC and our ratepayers, is consistent with our mission and policies, and does not in any way interfere with, endanger, or damage the SFPUC's current or future operations, security or facilities.[1] No secondary use of SFPUC land is permitted without the SFPUC's consent.

These controls rely on and reference several existing SFPUC policies, which should be read when noted in the document. Being mindful of these policies while planning a proposed use and submitting an application will ease the process for both the applicant and the SFPUC. These controls are subject to change over time and additional requirements and restrictions may apply depending on the project.

The SFPUC typically issues five-year revocable licenses for recreational use, with a form of rent and insurance required upon signing.[2]

Note: The project proponent is referred to as the "Applicant" until the license agreement is signed, at which point the project proponent is referred to as the "Licensee."

[1] SFPUC Guidelines for the Real Estate Services Division, Section 2.0.
[2] SFPUC Guidelines for the Real Estate Services Division, Section 3.3.

I. *Land Use, Structures, and Compliance with Law*

The following tenets govern the specifics of land use, structures, and accessibility for a project. Each proposal will still be subject to SFPUC approval on a case-by-case basis.

A. SFPUC Policies. The Applicant's proposed use must conform to policies approved by the SFPUC's Commission, such as the SFPUC's Land Use Framework (http://sfwater.org/index.aspx?page=586).

B. Americans with Disabilities Act Compliance. The Applicant must demonstrate that a Certified Access Specialist (CASp) has reviewed and approved its design and plans to confirm that they meet all applicable accessibility requirements.

C. Environmental Regulations. The SFPUC's issuance of a revocable license for use of the ROW is subject to compliance with the California Environmental Quality Act (CEQA). The Applicant is responsible for assessing the potential environmental impacts under CEQA of its proposed use of the ROW. The SFPUC must be named as a Responsible Agency on any CEQA document prepared for the License Area. In addition, the Applicant shall provide to SFPUC a copy of the approved CEQA document prepared by the Applicant, the certification date, and documentation of the formal approval and adoption of CEQA findings by the CEQA lead agency. The SFPUC will not issue a license for the use of the ROW until CEQA review and approval is complete.

D. Crossover and Other Reserved Rights. For a ROW parcel that bisects a third party's land, the Applicant's proposed use must not inhibit that party's ability to cross the ROW. The Applicant must demonstrate any adjoining owner with crossover or other reserved rights approves of the proposed recreational use and that the use does not impinge on any reserved rights.

E. Width. The License Area must span the entire width of the ROW.
   - *For example, the SFPUC will not allow a 10-foot wide trail license on a ROW parcel that is 60 feet wide.*

F. Structures. Structures on the ROW are generally prohibited. The Licensee shall not construct or place any structure or improvement in, on, under or about the entire License Area that requires excavation, bored footings or concrete pads that are greater than six inches deep.
   i. Structures such as benches and picnic tables that require shallow (four to six inches deep) cement pads or footings are generally permitted on the ROW. No such structure may be placed directly on top of a pipeline or within 20 feet of the edge of a pipeline.
   ii. The SFPUC will determine the permitted weight of structures on a case-by-case basis.

- *When the SFPUC performs maintenance on its pipelines, structures of significant weight and/or those that require footings deeper than six inches are very difficult and time-consuming to move and can pose a safety hazard to the pipelines. The longer it takes to reach the pipeline in an emergency, the more damage that can be caused.*

G. Paving Materials. Permitted trails or walkways should be paved with materials that both reduce erosion and stormwater runoff (e.g., permeable pavers).

H. License Area Boundary Marking. The License Area's boundaries should be clearly marked by landscaping or fencing, with the aim to prevent encroachments.

I. Fences and Gates. Any fence along the ROW boundary must be of chain-link or wooden construction with viewing access to the ROW. The fence must include a gate that allows SFPUC access to the ROW.[3] Any gate must be of chain-link construction and at least 12 feet wide with a minimum 6-foot vertical clearance.

II. *Types of Recreational Use*

Based on our past experience and research, the SFPUC will allow simple parks without play structures, community gardens and limited trails.

A. Fulfilling an Open Space Requirement. An applicant may not use the ROW to fulfill a development's open space, setback, emergency access or other requirements.[4] In cases where a public agency has received consideration for use of SFPUC land from a third party, such as a developer, the SFPUC may allow such recreational use if the public agency applicant pays full Fair Market Rent.

B. Trail Segments. At this time, the SFPUC will consider trail proposals when a multi-jurisdictional entity presents a plan to incorporate specific ROW parcels into a fully connected trail. Licensed trail segments next to unlicensed parcels may create a trail corridor that poses liability to the SFPUC. The SFPUC will only consider trail proposals where the trail would not continue onto, or encourage entry onto, another ROW parcel without a trail and the trail otherwise meet all SFPUC license requirements.

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[3] SFPUC Right of Way Requirements.

[4] SFPUC Guidelines for the Real Estate Services Division, Section 2.0.

III. *Utilities*

A. Costs. The Licensee is responsible for all costs associated with use of utilities on the License Area.

B. Placement. No utilities may be installed on the ROW running parallel to the SFPUC's pipelines, above or below grade.[5] With SFPUC approval, utilities may run perpendicular to the pipelines.

C. Lights. The Licensee shall not install any light fixtures on the ROW that require electrical conduits running parallel to the pipelines. With SFPUC approval, conduits may run perpendicular to and/or across the pipelines.
   - Any lighting shall have shielding to prevent spill over onto adjacent properties.

D. Electricity. Licensees shall purchase all electricity from the SFPUC at the SFPUC's prevailing rates for comparable types of electrical load, so long as such electricity is reasonably available for the Licensee's needs.

IV. *Vegetation*

A. The Applicant shall refer to the SFPUC Integrated Vegetation Management Policy for the *minimum* requirements concerning types of vegetation and planting. (http://www.sfwater.org/index.aspx?page=431.) The Licensee is responsible for all vegetation maintenance and removal.

B. The Applicant shall submit a Planting Plan as part of its application. *(Community garden applicants should refer to Section VII.C for separate instructions.)*
   i. The Planting Plan should include a layout of vegetation placement (grouped by hydrozone) and sources of irrigation, as well as a list of intended types of vegetation. The SFPUC will provide an area drawing including pipelines and facilities upon request.
   ii. The Applicant shall also identify the nursery(ies) supplying plant stock and provide evidence that each nursery supplier uses techniques to reduce the risk of plant pathogens, such as Phytophthora ramorum.

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[5] SFPUC Land Engineering Requirements.

V. *Measures to Promote Water Efficiency*[6]

A. The Licensee shall maintain landscaping to ensure water use efficiency.

B. The Licensee shall choose and arrange plants in a manner best suited to the site's climate, soil, sun exposure, wildfire susceptibility and other factors. Plants with similar water needs must be grouped within an area controlled by a single irrigation valve

C. Turf is not allowed on slopes greater than 25 percent.

D. The SFPUC encourages the use of local native plant species in order to reduce water use and promote wildlife habitat.

E. Recycled Water. Irrigation systems shall use recycled water if recycled water meeting all public health codes and standards is available and will be available for the foreseeable future.

F. Irrigation Water Runoff Prevention. For landscaped areas of any size, water runoff leaving the landscaped area due to low head drainage, overspray, broken irrigation hardware, or other similar conditions where water flows onto adjacent property, walks, roadways, parking lots, structures, or non-irrigated areas, is prohibited.

VI. *Other Requirements*

A. Financial Stability. The SFPUC requires municipalities or other established organizations with a strong fiscal history as Licensees.
   i. Applicants must also demonstrate sufficient financial backing to pay rent, maintain the License Area, and fulfill other license obligations over the license term.
   ii. Smaller, community-based organizations without 501(c)(3) classifications must partner with a 501(c)(3) classified organization or any other entity through which it can secure funding for the License Area over the license term.

B. Maintenance. The Licensee must maintain the License Area in a clean and sightly condition at its sole cost.[7] Maintenance includes, but is not limited to, regular weed abatement, mowing, and removing graffiti, dumping, and trash.

C. Mitigation and Restoration. The Licensee will be responsible, at its sole cost, for removing and replacing any recreational improvements in order to accommodate

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[6] SFPUC Rules and Regulations Governing Water Service to Customers, Section F.

[7] SFPUC Framework for Land Management and Use.

planned or emergency maintenance, repairs, replacements, or projects done by or on behalf of the SFPUC. If the Licensee refuses to remove its improvements, SFPUC will remove the improvements I at the Licensee's sole expense without any obligation to replace them.

D. Encroachments. The Licensee will be solely responsible for removing any encroachments on the License Area. An encroachment is any improvement on SFPUC property not approved by the SFPUC. Please read the SFPUC ROW Encroachment Policy for specific requirements. If the Licensee fails to remove encroachments, the SFPUC will remove them at Licensee's sole expense. The Licensee must regularly patrol the License Area to spot encroachments and remove them at an early stage.

E. Point of Contact. The Licensee will identify a point of contact (name, position title, phone number, and address) to serve as the liaison between the Licensee, the local community, and the SFPUC regarding the License Agreement and the License Area. In the event that the Point of Contact changes, the Licensee shall immediately provide the SFPUC with the new contact information. Once the License Term commences, the Point of Contact shall inform local community members to direct any maintenance requests to him or her. In the event that local community members contact the SFPUC with such requests, the SFPUC will redirect any requests or complaints to the Point of Contact.

F. Community Outreach.

   i. Following an initial intake conversation with the SFPUC, the Applicant shall provide a Community Outreach Plan for SFPUC approval. This Plan shall include the following:
      1. Identification of key stakeholders who will be reached out to and/or asked for input, along with their contact information
      2. Description of outreach strategy, tactics, and materials
      3. Timeline of outreach (emails/letters mailing date, meetings, etc.)
      4. Description of how the Applicant will incorporate feedback into its proposal
   ii. The Applicant shall conduct outreach for the project at its sole cost and shall keep the SFPUC apprised of any issues arising during outreach.
   iii. During outreach, the Applicant shall indicate that it in no way represents the SFPUC.

G. Signage. The SFPUC will provide, at Licensee's cost, a small sign featuring the SFPUC logo and text indicating SFPUC ownership of the License Area at each entrance. In addition, the Licensee will install, at its sole cost, an accompanying sign at each entrance to the License Area notifying visitors to contact the Point of Contact should they have any issues. The SFPUC must approve the design and placement of Licensee's sign.

VII. *Community Gardens*

The following requirements also apply to community garden sites. As with all projects, the details of the operation of a particular community garden are approved on a case-by-case basis.

A. The Applicant must demonstrate stable funding. The Applicant must provide information about grants received, pending grants, and any ongoing foundational support.

B. The Applicant must have an established history and experience in managing urban agriculture and gardening projects.

C. The Applicant shall submit a Community Garden Planting Plan that depicts the proposed License Area with individual plot placements, landscaping, and a list of crops that might be grown in the garden.

D. The Applicant shall designate a Garden Manager to oversee day-to-day needs and serve as a liaison between the SFPUC and garden plot holders. The Garden Manager may be distinct from the Point of Contact, see Section VI.E.

E. The Licensee must ensure that the Garden Manager informs plot holders about the potential for and responsibilities related to SFPUC repairs or emergency maintenance on the License Area. In such circumstances, the SFPUC is not liable for the removal and replacement of any features on the License Area or the costs associated with such removal and replacement.

F. The Licensee must conduct all gardening within planter boxes with attached bottoms that allow for easy removal without damaging the crops.

PROPOSED

AMENDMENT TO

RIGHT OF WAY INTEGRATED VEGETATION MANAGEMENT POLICY

DRAFT

13.000 RIGHT OF WAY INTEGRATED VEGETATION MANAGEMENT POLICY

13.001 General

The following policy is established to manage vegetation on the distribution and collection systems that poses a threat or hazard to the system's integrity and infrastructure. The San Francisco Public Utilities Commission is responsible for the conveyance of potable water and recovery of wastewater for some ~~780~~800,000 customers within the City of San Francisco; it is also responsible for the conveyance of potable water to ~~29~~ 26 other water retailers with a customer base of 1.~~5~~ 8 million.

The existence of large woody vegetation[1], hereinafter referred to as vegetation, and water transmission lines are not compatible and, in fact, are mutually exclusive uses of the same space. It has been our experience that roots can impact transmission pipelines by causing corrosion to the outer casements. It has also been our experience that the existence of trees and other vegetation directly adjacent to pipelines makes emergency and annual maintenance very difficult, hazardous, expensive and increases concerns for public safety. The fire danger within the rights-of-way is always a concern and the reduction of fire ladder fuels within these corridors is another reason to modify the vegetation mosaic. The SFPUC must comply with local fire ordinances thus requiring that existing vegetation must be identified, reduced, and managed in an appropriate and timely manner to prevent any potential disruption in service.

One of the other objectives of this policy is to reduce and eliminate as much as practicable the use of herbicides on vegetation within the right-of-way.

13.002 Woody Vegetation Management

1.0 Vegetation of any size or species will not be allowed to grow within certain critical portions of the rights-of-way, pumping stations or other facilities as determined by a SFPUC qualified professional, and generally in accordance with the following guidelines.

1.1 Emergency Removal

Vegetation that has been assessed by SFPUC Management to pose an immediate threat to the transmission lines, human life and property due to acts of God, insects, disease, or natural mortality will be removed without prior public notification.

1.2 Priority Removal

Vegetation that is within 15 feet of the edge of any pipe will be cut down, bucked up into short lengths and chipped whenever possible. Chips will be spread upon the site where the vegetation was removed. Material that cannot be chipped will be hauled away to a proper disposal site.

If vegetation along the rights-of-way is grouped in contiguous stands[2], or populations, a systematic and staggered removal of that vegetation will be undertaken to replicate a natural appearance. Initial removal[3] will be vegetation immediately above or within 15 feet of the pipeline edges~~,~~; secondary vegetation[4] to be removed will be those that are 15 to 25 feet from the edge of the pipes.

1.3 Standard Removal

Vegetation that is more than 25 feet from the edge of a pipeline and up to the boundary of the right-of-way will be assessed by a SFPUC qualified professional on its age and condition, fire risk, potential impact to the pipe lines, and will be removed or retained in a like manner as stated above as deemed necessary.

1.4 Removal Standards

Each Operating Division will develop their own set of guidelines or follow established requirements in accordance with the needs and demands of their local zones of influence.

2.0 All stems of vegetation will be cut flush with the ground and where deemed necessary or appropriate, roots will be removed. All trees identified for removal will be clearly marked with paint and/or a numbered aluminum tag.

3.0 Sprouting species of vegetation will be treated with herbicides where practicable and adhering to provisions of the pesticide ordinances.

4.0 Erosion control measures, where needed, will be completed before the work crew or contractors leave the work site or before October 15 of the calendar year as those measures are needed.

5.0 Department personnel will remove in a timely manner any and all material that has been cut for maintenance purposes within any stream channel.

6.0 All vegetation removal work and consultation on vegetation retention will be reviewed and supervised by a SFPUC qualified professional on a case-by-case basis.

7.0 Notification process for areas of significant resource impact that are beyond regular and ongoing maintenance:

7.1 County/City Notification – The individual Operating Division will have sent to the affected county/city a map showing the sections of the rights-of-way which will be worked, a written description of the work to be done, the appropriate removal time for the work crews, and a contact person for more information. This should be done approximately 10 days prior to start of work. Each Operating Division will develop their own set of guidelines in accordance with the needs of their local zones of influence.

7.2 Public Notification – The Operating Division will have notices posted at areas where the vegetation is to be removed with the same ~~informaiton~~information as above also approximately 10 days prior to removal. Notices will also be sent to all adjacent residents within 300 feet of the removal site. Posted notices will be 11" by 17" in size on colored paper and will be put up at each end of the project area and at crossover points through the right-of-way. Questions and complaints from the public will be handled through a designated contact person. Each Operating Division will develop their own set of guidelines in accordance with the needs of their local zones of influence.

13.003 Annual Grass and Weed Management

Annual grasses and weeds will be mowed, disked, sprayed or mulched along the rights-of-way as appropriate to reduce vegetation and potential fire danger annually. This treatment should be completed before July 30 of each year. This date is targeted to allow the grasses, forbs and weeds to reach maturity and facilitate control for the ~~reason~~season.

13.004 Segments of Right-of-Way that are covered by Agricultural deed rights

The only vegetation that will be allowed to be planted within the right-of-way on those segments where an adjacent neighbor has Deeded Agricultural Rights will be: non woody herbaceous plants such as grasses, flowers, bulbs, or vegetables.

13.005 Segments of Right-of-Way that are managed and maintained on a ~~Leased or Permit~~Licensed basis

Special allowance may be made for these types of areas, as the vegetation will be maintained by the permitted user as per agreement with the City, and not allowed to grow unchecked. Only shallow rooted plants will be allowed to be planted directly above the pipes.

Within the above segments, the cost of vegetation maintenance and removal will be ~~born~~borne by the ~~permittee or lessee~~licensee exclusively. In a like fashion, when new vegetative encroachments are discovered they will be assessed by a SFPUC qualified professional on a case-by-case basis and either be permitted or proposed for removal.

The following is a guideline of the size at maturity of plants (small trees, shrubs, and groundcover) that may be permitted to be used as landscape materials:

Plants that may be permitted to be planted directly above existing and future pipelines: ground cover, grasses, flowers, and very low growing plants that reach no more than one foot in height at maturity.

Plants that may be permitted to be planted 15 – 25 feet from the edge of existing and future pipelines: shrubs and plants that grow no more than five feet tall in height at maturity.

Plants that may be permitted to be planted 25 feet or more from the edge of existing and future pipelines: small trees or shrubs that grow to a maximum of twenty feet in height and fifteen feet in canopy width or less.

Low water use plant species are encouraged and invasive plant species are discouraged.

All appurtenances, vaults, and facility infrastructure must remain visible and accessible at all times.

~~The following is a suggested list of drought tolerant plants and shrubs that may be permitted to be used as landscaping materials:~~

~~Listing of Plants that may be permitted to be planted directly above existing and future pipelines~~

~~Agapanthus Bergenia Blue Fescue Blue Oat Grass Cranesbill Daylilies~~

~~English Ivy Erigeron Fortnight Lily Fountain Grass Gaillardia Gaura~~

~~Gazania Germander Ice Plants Iris Lantana Lavendar~~

~~Lily Mexican Sage Monkey flower Penstemon Periwinkle Poppy~~

~~Primrose Rock Rose Sage Santolina Santa Barbara Daisy Sea Pink~~

~~Sea Statice Shrub Rose Trumpet Vine Wallflower Yarrow~~

~~Listing of Shrubs that may be permitted to be planted 15 feet from edge of existing and future pipelines~~

~~Australian Blue Creeper Australian Fuschia Australian Tea Tree Barberry Bush Anemone Catalina Cherry~~

~~Ceanothus Coffeeberry Cotoneaster Cultivars of each species Currant Dwarf Olive~~

~~Escallonia Garrya Grevillea Hollyleaf Cherry Indian Hawthorn Manzanita~~

~~Mahonia Oleander Pacific Wax Myrtle Pineapple Guava Pittosporum Rosemary~~

~~Sarcococca Strawberry Tree Sugar Bush Toyon Westringia Xylosma~~

13.006 Trees on the Right-of-Way

Trees ~~of any species~~ will be allowed within a ~~permitted or leased~~licensed area provided they are in containers and are above ground. ~~Trees of an acceptable species may remain or be planted in the ground along the outer edges of the right-of-way provided that the following requirements are met:~~

~~1. No trees (regardless of species) will be permitted on or within 15' of any pipeline edge.~~

~~2. The following tree species* may permitted beyond 15' from any pipeline edge:~~

~~Dogwood Dwarf citrus Dwarf fruit Redbud~~

~~3. The following tree species* may permitted beyond 25' from any pipeline edge:~~

Alder Birch Buckeye Crab Apple Fig Hawthorn

Holly Hornbeam Maple Mulberry Nutmeg Olive

Quince Regular Citrus Regular Fruit Smoketree Sweet Gum Tulip Tree

4. The following tree species* are not permitted on any right-of-way property:

Acacia Arbor-vitae Ash Basswood Bay Beech

Black Walnut Catalpa Cedars Chestnut Cottonwood Cypress

Elms English Walnut Eucalyptus Firs Hemlock Hickory

Ginkgo Juniper Larch Locust Madrone Magnolia

Oaks Pines Poplar sp. Plane Redwood Sycamore

Tree of Heaven Willows

Note: All distance measurements are for mature trees measured from the edge of the trees drip-line to the edge of the pipeline.

* Cultivars of species listed above will be judged on a case-by-case basis based on predicted grown characteristics. All determinations of species acceptability will be made by a SFPUC Forester or other qualified SFPUC staff.

The above policy is for general application and for internal administration purposes only and may not be relied upon by any third party for any reason whatsoever. The San Francisco Public Utilities Commission reserves the right at its sole discretion, to establish stricter policies in any particular situation and to revise and update the above policy at any time.

Definitions:

1. Woody Vegetation. All Brush, Tree and Ornamental Shrub Species planted in or naturally occurring in the native soil that havesoil that has a woody stem that at maturity exceeds 3 inches.

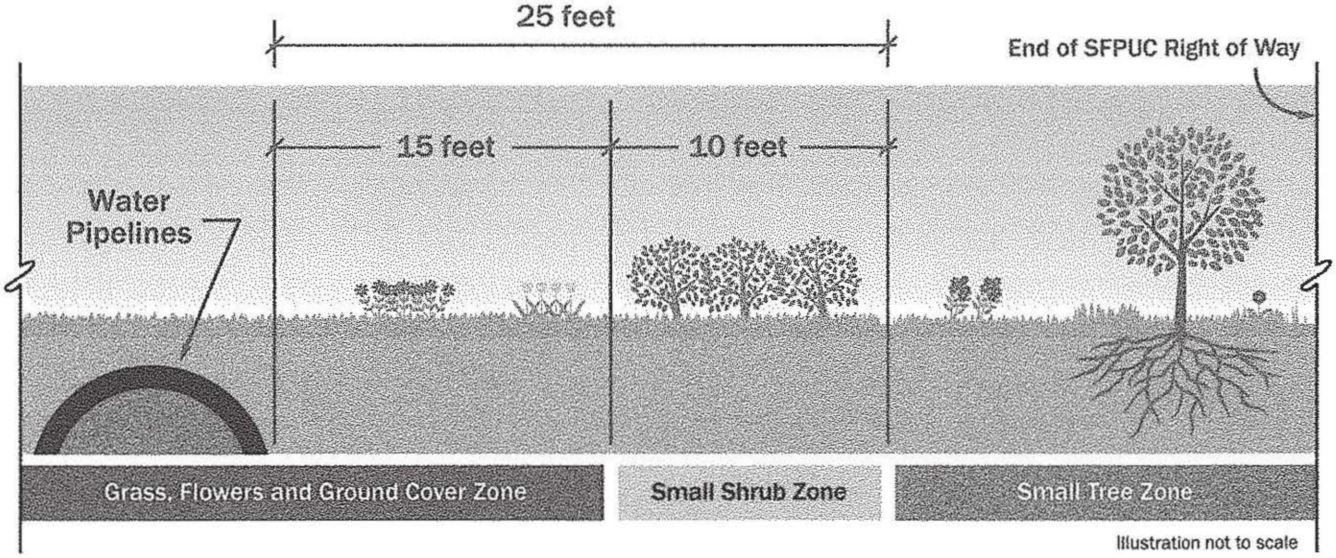
2. Stand. Community of trees possessing sufficient uniformity in composition, structure, age, arrangement, or condition to be distinguishable from adjacent forest communities to form a management unit.

3. Initial removal. Base year or first year of cutting.

4. Secondary vegetation. Second year following the base year for cutting.

San Francisco Public Utilities Commission (SFPUC)

Right Of Way (ROW) Landscape Vegetation Guidelines



The following vegetation types are permitted on the ROW within the appropriate zones.

Plantings that may be permitted directly above existing and future pipelines:

Ground cover, grasses, flowers, and very low growing plants that reach no more than one foot in height at maturity.

Plantings that may be permitted 15–25 feet from the edge of existing and future pipelines:

Shrubs and plants that grow no more than five feet tall in height at maturity.

Plantings that may be permitted 25 feet or more from the edge of existing and future pipelines:

Small trees or shrubs that grow to a maximum of twenty feet in height and fifteen feet in canopy width or less.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay National Wildlife Refuge Complex
9500 Thornton Avenue
Newark, California 94560

October 16, 2006

City of East Palo Alto
Planning Division
2200 University Ave.
East Palo Alto, CA 94303

SUBJECT: REQUEST TO BE ADDED TO THE CITY'S DISTRIBUTION LIST FOR PUBLIC NOTICES AND ENVIRONMENTAL DOCUMENTS

Dear Planning Division:

The U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, owns and/or manages various parcels of land throughout the City of East Palo Alto for the purpose of conserving and enhancing wildlife populations and their habitats. As a property owner, we are interested in receiving all public notices and environmental documents for public and private projects and other actions proposed within your jurisdiction that potentially effect wildlife resources on refuge lands. The enclosed map indicates the boundaries for the Refuge within or near the City which should assist you in determining which projects or actions should be forwarded to us for review and consideration.

Please direct all notices and other materials to:

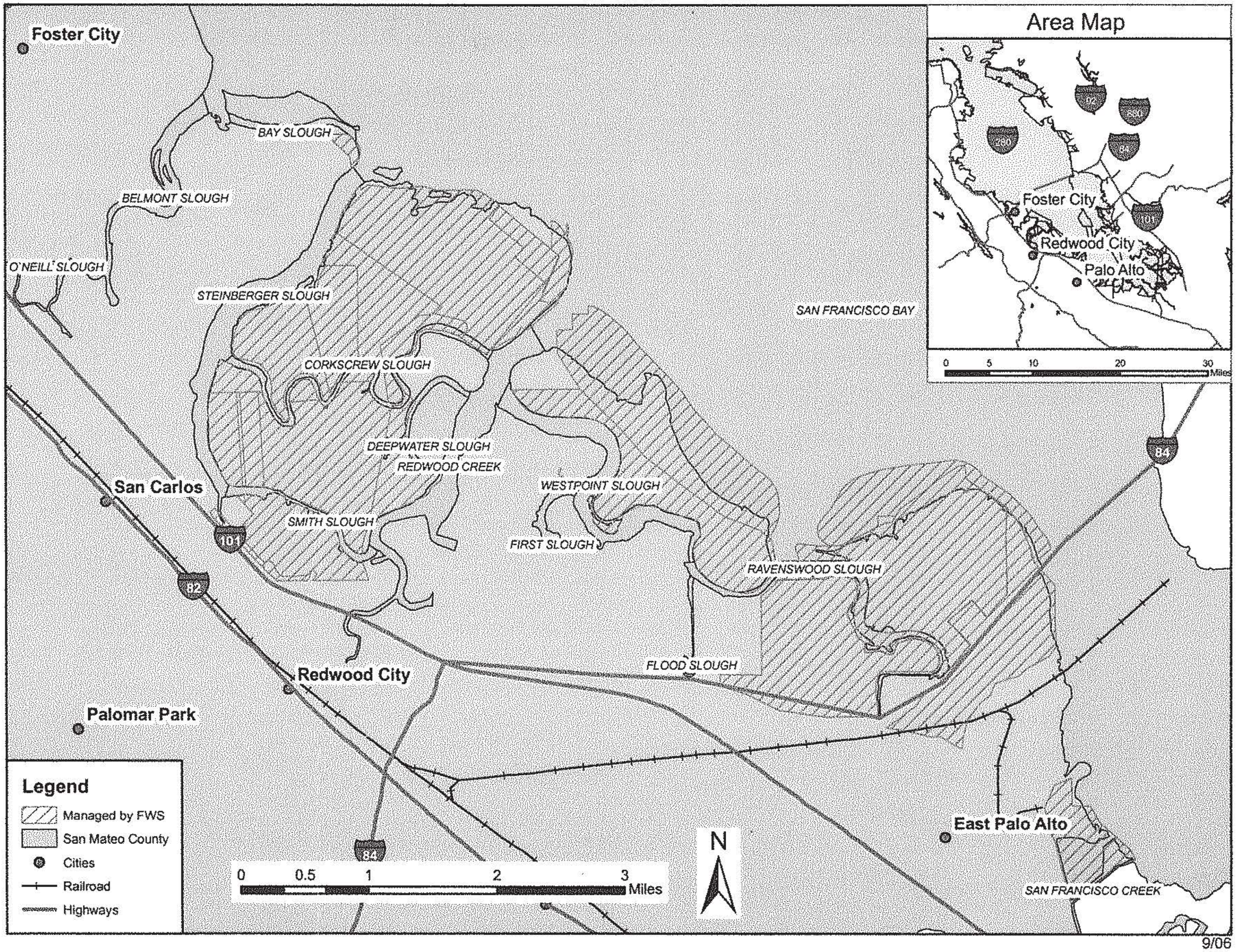
Winnie Chan
U.S. Fish and Wildlife Service
San Francisco Bay National Wildlife Refuge Complex
9500 Thornton Avenue
Newark, CA 94560

We appreciate your attention to this matter. Should you have any questions, please contact Winnie Chan, the Refuge Planner, at 510-792-0222, x45.

Sincerely,

G. Mendel Stewart
Project Leader
San Francisco Bay National Wildlife Refuge Complex

Don Edwards National Wildlife Refuge- San Mateo County Area



"Anne Cook" <acook@cityofepa.org> November 21, 2014 4:18 PM
To: cookumup@gmail.com
FW: NOP comment letter

From: Ramirez, Tim [mailto:TRamirez@sfwater.org]
Sent: Friday, October 03, 2014 12:58 PM
To: Anne Cook
Cc: Russell, Rosanna S; Torrey, Irina; Natesan, Ellen; Freeman, Craig; Wilson, Joanne
Subject: NOP comment letter

October 3, 2014

Anne Cook, General Plan Project Manager
City of East Palo Alto, Community and Economic Development Department

Dear Anne,

The Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the East Palo Alto General Plan and Zoning Code Update found its way to my desk today – which is the deadline for comments on the NOP. Given the presence of SFPUC land and water supply system facilities within the City of East Palo Alto, we have an interest in this project has it moves forward, and would like to make sure we receive a copy of the Draft EIR when its available, as well as notice to any future public meetings related to the project.

Please update your records to include my name and Joanne Wilson as the points of contact for this project. Joanne's contact information is below.

Thank you.

Sincerely,
TR

Tim Ramirez
Natural Resources and Lands Management Division Manager
Water Enterprise
525 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
office: (415) 554-3265 | fax: (415) 934-5770

Joanne C. Wilson, AICP
Senior Land and Resources Planner
Natural Resources and Lands Management Division / Water Enterprise
San Francisco Public Utilities Commission
Hetch Hetchy Regional Water System
1657 Rollins Road
Burlingame, CA 94010-2310
Tel: (650) 652-3205
Fax: (650) 652-3219
Email: jwilson@sfwater.org

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APPENDIX B

Air Quality and Greenhouse Gas Emissions Assessment

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CITY OF EAST PALO ALTO GENERAL PLAN UPDATE EIR AIR QUALITY AND GREENHOUSE GAS EMISSIONS ASSESSMENT

January 26, 2016

♦ ♦ ♦

Prepared for:

John Cook, AICP
Senior Project Manager
Circlepoint
1814 Franklin Street, Suite 1000
Oakland, CA 94612

Prepared by:

Joshua D. Carman

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

1 Willowbrook Court, Suite 120
Petaluma, CA 94954
(707) 794-0400

Project: 13-140

INTRODUCTION

This report examines air quality and greenhouse gas (GHG) emissions in the Planning Area and region, includes a summary of applicable air quality and GHG regulations, and analyzes potential air quality and GHG impacts associated with the proposed East Palo Alto General Plan Update.

REGULATORY FRAMEWORK

Pursuant to the federal Clean Air Act (CAA) of 1970, the U.S. Environmental Protection Agency (EPA) established national ambient air quality standards (NAAQS). The NAAQS were established for major pollutants, termed "criteria" pollutants. Criteria pollutants are defined as those pollutants for which the federal and State governments have established ambient air quality standards, or criteria, for outdoor concentrations in order to protect public health.

Both the EPA and the California Air Resources Board (CARB) have established ambient air quality standards for common pollutants: carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and suspended particulate matter (PM). In addition, the State has set standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles. These standards are designed to protect the health and welfare of the public with a reasonable margin of safety. These ambient air quality standards are levels of contaminants which represent safe levels that avoid specific adverse health effects associated with each criteria pollutant.

Health effects of criteria pollutants and their potential sources are described below and summarized in Table 1.

TABLE 1. Health Effects of Air Pollutants

Pollutants	Sources	Primary Effects
Carbon Monoxide (CO)	• Incomplete combustion of fuels and other carbon-containing substances, such as motor exhaust. • Natural events, such as decomposition of organic matter.	• Reduced tolerance for exercise. • Impairment of mental function. • Impairment of fetal development. • Death at high levels of exposure. • Aggravation of some heart diseases (angina).
Nitrogen Dioxide (NO_2)	• Motor vehicle exhaust. • High temperature stationary combustion. • Atmospheric reactions.	• Aggravation of respiratory illness. • Reduced visibility. • Reduced plant growth. • Formation of acid rain.

Pollutants	Sources	Primary Effects
Ozone (O_3)	• Atmospheric reaction of organic gases with nitrogen oxides in sunlight.	• Aggravation of respiratory and cardiovascular diseases. • Irritation of eyes. • Impairment of cardiopulmonary function. • Plant leaf injury.
Lead (Pb)	• Contaminated soil.	• Impairment of blood functions and nerve construction. • Behavioral and hearing problems in children.
Suspended Particulate Matter ($PM_{2.5}$ and PM_{10})	• Stationary combustion of solid fuels. • Construction activities. • Industrial processes. • Atmospheric chemical reactions.	• Reduced lung function. • Aggravation of the effects of gaseous pollutants. • Aggravation of respiratory and cardiorespiratory diseases. • Increased cough and chest discomfort. • Soiling. • Reduced visibility.
Sulfur Dioxide (SO_2)	• Combustion of sulfur-containing fossil fuels. • Smelting of sulfur-bearing metal ores. • Industrial processes.	• Aggravation of respiratory diseases (asthma, emphysema). • Reduced lung function. • Irritation of eyes. • Reduced visibility. • Plant injury. • Deterioration of metals, textiles, leather, finishes, coatings, etc.
Toxic Air Contaminants	• Cars and trucks, especially diesels. • Industrial sources such as chrome platers. • Neighborhood businesses such as dry cleaners and service stations. • Building materials and product.	• Cancer. • Chronic eye, lung, or skin irritation. • Neurological and reproductive disorders.

Source: CARB, 2008.

Air Pollutants

Ozone

Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and oxides of nitrogen (NO_X). The main sources of ROG and NO_X, often referred to as ozone precursors, are combustion processes (including combustion in motor vehicle engines) and the evaporation of solvents, paints, and fuels. In the Bay Area, automobiles are the single largest source of ozone precursors. Ozone is referred to as a regional air pollutant because its precursors are transported and diffused by wind concurrently with ozone production through the photochemical reaction process. Ozone causes eye irritation, airway constriction, and shortness of breath and can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema.

Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The single largest source of CO is motor vehicles. While CO transport is limited, it disperses with distance from the source under normal meteorological conditions. However, under certain extreme meteorological conditions, CO concentrations near congested roadways or intersections may reach unhealthful levels that adversely affect local sensitive receptors (e.g., residents, schoolchildren, the elderly, hospital patients, etc.). Typically, high CO concentrations are associated with roadways or intersections operating at unacceptable levels of service (LOS) or with extremely high traffic volumes. Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and can cause headaches, nausea, dizziness, and fatigue, impair central nervous system function, and induce angina (chest pain) in persons with serious heart disease. Very high levels of CO can be fatal.

Nitrogen Dioxide

NO_2 is a reddish brown gas that is a byproduct of combustion processes. Automobiles and industrial operations are the main sources of NO_2. Aside from its contribution to ozone formation, NO_2 also contribute to other pollution problems, including a high concentration of fine particulate matter, poor visibility, and acid deposition. NO_2 may be visible as a coloring component on high pollution days, especially in conjunction with high ozone levels. NO_2 decreases lung function and may reduce resistance to infection. On January 22, 2010 the EPA strengthened the health-based NAAQS for NO_2.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless, irritating gas formed primarily from incomplete combustion of fuels containing sulfur. Industrial facilities also contribute to gaseous SO_2 levels in the region.

SO_2 irritates the respiratory tract, can injure lung tissue when combined with fine particulate matter, and reduces visibility and the level of sunlight.

Particulate Matter

Particulate matter is the term used for a mixture of solid particles and liquid droplets found in the air. Coarse particles are those that are larger than 2.5 microns but smaller than 10 microns, or PM_{10}. $PM_{2.5}$ refers to fine suspended particulate matter with an aerodynamic diameter of 2.5 microns or less that is not readily filtered out by the lungs. Nitrates, sulfates, dust, and combustion particulates are major components of PM_{10} and $PM_{2.5}$. These small particles can be directly emitted into the atmosphere as by-products of fuel combustion through abrasion, such as tire or brake lining wear, or through fugitive dust (wind or mechanical erosion of soil). They can also be formed in the atmosphere through chemical reactions. Particulates may transport carcinogens and other toxic compounds that adhere to the particle surfaces, and can enter the human body through the lungs.

Lead

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been mobile and industrial sources. As a result of the phase-out of leaded gasoline, metal processing is currently the primary source of lead emissions. The highest levels of lead in air are generally found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufactures.

Twenty years ago, mobile sources were the main contributor to ambient lead concentrations in the air. In the early 1970s, the U.S. EPA established national regulations to gradually reduce the lead content in gasoline. In 1975, unleaded gasoline was introduced for motor vehicles equipped with catalytic converters. The EPA banned the use of leaded gasoline in highway vehicles in December 1995. As a result of the EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector and levels of lead in the air decreased dramatically.

Toxic Air Contaminants (TACs)

In addition to the criteria pollutants discussed above, Toxic Air Contaminants (TACs) are another group of pollutants of concern. TACs are injurious in small quantities and are regulated by the EPA and the CARB. Some examples of TACs include: benzene, butadiene, formaldehyde, and hydrogen sulfide. The identification, regulation, and monitoring of TACs is relatively recent compared to that for criteria pollutants.

High volume freeways, stationary diesel engines, and facilities attracting heavy and constant diesel vehicle traffic (distribution centers, truck stops) were identified as posing the highest risk to adjacent receptors. Other facilities associated with increased risk include warehouse distribution centers, large retail or industrial facilities, high volume transit centers, or schools with a high volume of bus traffic. Health risks from TACs are a function of both concentration and duration of exposure.

Sensitive Receptors

Some groups of people are more affected by air pollution than others. The State has identified the following people who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks.

Federal Air Quality Regulations

At the federal level, the EPA has been charged with implementing national air quality programs. EPA's air quality mandates are drawn primarily from the Federal Clean Air Act (FCAA), which was enacted in 1963. The FCAA was amended in 1970, 1977, and 1990.

The FCAA required EPA to establish primary and secondary NAAQS and required each State to prepare an air quality control plan referred to as a State Implement Plan (SIP). Federal standards include both primary and secondary standards. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.[1] The Federal Clean Air Act Amendments of 1990 (FCAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. EPA has responsibility to review all state SIPs to determine conformity with the mandates of the FCAAA and determine if implementation will achieve air quality goals. If the EPA determines a SIP to be inadequate, a Federal Implementation Plan (FIP) may be prepared for the nonattainment area which imposes additional control measures. Failure to submit an approvable SIP or to implement the plan within the mandated timeframe may result in the application of sanctions on transportation funding and stationary air pollution sources in the air basin.

The 1970 FCAA authorized the establishment of national health-based air quality standards and also set deadlines for their attainment. The FCAA Amendments of 1990 changed deadlines for attaining NAAQS as well as the remedial actions required of areas of the nation that exceed the

[1] U.S. Environmental Protection Agency, 2013. Website: www.epa.gov/air/criteria.html. February.

standards. Under the FCAA, State and local agencies in areas that exceed the NAAQS are required to develop SIPs to show how they will achieve the NAAQS by specific dates. The FCAA requires that projects receiving federal funds demonstrate conformity to the approved SIP and local air quality attainment plan for the region. Conformity with the SIP requirements would satisfy the FCAA requirements.

State Air Quality Regulations

The CARB is the agency responsible for the coordination and oversight of State and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA), adopted in 1988. The CCAA requires that all air districts in the State achieve and maintain the California Ambient Air Quality Standards (CAAQS) by the earliest practical date. The CCAA specifies that districts should focus on reducing the emissions from transportation and air-wide emission sources, and provides districts with the authority to regulate indirect sources.

CARB is also responsible for developing and implementing air pollution control plans to achieve and maintain the NAAQS. CARB is primarily responsible for statewide pollution sources and produces a major part of the SIP. Local air districts provide additional strategies for sources under their jurisdiction. CARB combines this data and submits the completed SIP to the EPA. Other CARB duties include monitoring air quality (in conjunction with air monitoring networks maintained by air pollution control and air quality management districts), establishing CAAQS (which in many cases are more stringent than the NAAQS), determining and updating area designations and maps, and setting emissions standards for new mobile sources, consumer products, small utility engines, and off-road vehicles.

Attainment Status Designations

The CARB is required to designate areas of the State as attainment, nonattainment, or unclassified for all State standards. An “attainment” designation for an area signifies that pollutant concentrations did not violate the standard for that pollutant in that area. A “non-attainment” designation indicates that a pollutant concentration violated the standard at least once, excluding those occasions when a violation was caused by an exceptional event, as defined in the criteria. An “unclassified” designation signifies that data does not support either an attainment or nonattainment status. The CCAA divides districts into moderate, serious, and severe air pollution categories, with increasingly stringent control requirements mandated for each category.

Table 2 shows the State and federal standards for criteria pollutants and provides a summary of the attainment status for the San Francisco Bay Area with respect to national and State ambient air quality standards.

TABLE 2. San Francisco Bay Area Attainment Status

Pollutant	Averaging Time	California Standards [a]		National Standards [b]	
		Concentration	Attainment Status	Concentration	Attainment Status
Carbon Monoxide (CO)	8-Hour	9 ppm (10 mg/m^3)	Attainment	9 ppm (10 mg/m^3)	Attainment [f]
	1-Hour	20 ppm (23 mg/m^3)	Attainment	35 ppm (40 mg/m^3)	Attainment
Nitrogen Dioxide (NO_2)	Annual Mean	0.030 ppm (57 mg/m^3)	Attainment	0.053 ppm (100 µg/m^3)	Attainment
	1-Hour	0.18 ppm (338 µg/m^3)	Attainment	0.100 ppm [j]	Unclassified
Ozone (O_3)	8-Hour	0.07 ppm (137 µg/m^3)	Nonattainment [h]	0.075 ppm	Nonattainment [d]
	1-Hour	0.09 ppm (180 µg/m^3)	Nonattainment	Not Applicable	Not Applicable [e]
Suspended Particulate Matter (PM_{10})	Annual Mean	20 µg/m^3	Nonattainment [g]	Not Applicable	Not Applicable
	24-Hour	50 µg/m^3	Nonattainment	150 µg/m^3	Unclassified
Suspended Particulate Matter ($PM_{2.5}$)	Annual Mean	12 µg/m^3	Nonattainment [g]	12 µg/m^3	Attainment
	24-Hour	Not Applicable	Not Applicable	35 µg/m^3 See footnote [i]	Nonattainment
Sulfur Dioxide (SO_2) [k]	Annual Mean	Not Applicable	Not Applicable	80 µg/m^3 (0.03 ppm)	Attainment
	24-Hour	0.04 ppm (105 µg/m^3)	Attainment	365 µg/m^3 (0.14 ppm)	Attainment
	1-Hour	0.25 ppm (655 µg/m^3)	Attainment	0.075 ppm (196 µg/m^3)	Attainment

[a] California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM_{10}, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, Lake Tahoe carbon monoxide, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), then some measurements may be excluded. In particular, measurements are excluded that CARB determines would occur less than once per year on the average.

[b] National standards shown are the "primary standards" designed to protect public health. National standards other than for ozone, particulates and those based on annual averages are not to be exceeded more than once a year. The 1-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 3-year average of the 4th highest daily concentrations is 0.075 ppm (75 ppb) or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m^3. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of 98th percentiles is less than 35 µg/m^3.

Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM_{10} is met if the 3-year average falls below the standard at every site. The annual $PM_{2.5}$ standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

[c] National air quality standards are set by EPA at levels determined to be protective of public health with an adequate margin of safety.

[d] On September 22, 2011, the EPA announced it will implement the current 8-hour ozone standard of 75 ppb. The EPA expects to finalize initial area designations for the 2008 8-hour ozone standard by mid-2012.

[e] The national 1-hour ozone standard was revoked by EPA on June 15, 2005.

[f] In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.

[g] In June 2002, CARB established new annual standards for $PM_{2.5}$ and PM_{10}. Statewide VRP 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 10-mile nominal visual range.

[h] The 8-hour CA ozone standard was approved by the CARB on April 28, 2005 and became effective on May 17, 2006.

[i] EPA lowered the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ in 2006. EPA designated the Bay Area as nonattainment of the $PM_{2.5}$ standard on October 8, 2009. The effective date of the designation is December 14, 2009, and the Air District has three years to develop a SIP that demonstrates the Bay Area will achieve the revised standard by December 14, 2014. The SIP for the new $PM_{2.5}$ standard must be submitted to the EPA by December 14, 2012.

[j] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100ppm (effective January 22, 2010).

[k] On June 2, 2010, the EPA established a new 1-hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. The existing 0.030 ppm annual and 0.14 ppm 24-hour SO_2 NAAQS however must continue to be used until one year following EPA initial designations of the new 1-hour SO_2 NAAQS. EPA expects to designate areas by June 2012.

Lead (Pb) is not listed in the above table because it has been in attainment since the 1980s.

ppm = parts per million
mg/m^3 = milligrams per cubic meter
$\mu g/m^3$ = micrograms per cubic meter

Source: Bay Area Air Quality Management District, 2013.

California Clean Air Act

In 1988, the CCAA required that all air districts in the State endeavor to achieve and maintain CAAQS for carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) by the earliest practical date. The CCAA provides districts with authority to regulate indirect sources and mandates that air quality districts focus particular attention on reducing emissions from transportation and area-wide emission sources. Each nonattainment district is required to adopt a plan to achieve a 5 percent annual reduction, averaged over consecutive 3-year periods, in district-wide emissions of each nonattainment pollutant or its precursors. A Clean Air Plan shows how a district would reduce emissions to achieve air quality standards. Generally, the State standards for these pollutants are more stringent than the national standards.

California Air Resources Board Handbook

In 1998, CARB identified particulate matter from diesel-fueled engines as a TAC. CARB has completed a risk management process that identified potential cancer risks for a range of activities using diesel-fueled engines.[2] The CARB subsequently developed an Air Quality and Land Use Handbook[3] (Handbook) in 2005 that is intended to serve as a general reference guide for evaluating and reducing air pollution impacts associated with new projects that go through the land use decision-making process. The CARB Handbook recommends that planning agencies consider proximity to air pollution sources when considering new locations for “sensitive” land uses such as residences, medical facilities, daycare centers, schools, and playgrounds.

Air pollution sources of concern include freeways, rail yards, ports, refineries, distribution centers, chrome plating facilities, dry cleaners, and large gasoline service stations. Key recommendations in the Handbook relative to East Palo Alto include taking steps to consider or avoid siting new, sensitive land uses:

- Within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day.
- Within 300 feet of gasoline fueling stations.
- Within 300 feet of dry cleaning operations (note that dry cleaning with TACs will is being phased out and will be prohibited in 2023).

Bay Area Air Quality Management District

The Bay Area Air Quality Management District (BAAQMD) seeks to attain and maintain air quality conditions in the San Francisco Bay Area Air Basin through a comprehensive program of planning, regulation, enforcement, technical innovation, and education. The clean air strategy includes the preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations, and issuance of permits for stationary sources. The BAAQMD also inspects stationary sources and responds to citizen complaints, monitors ambient air quality and meteorological conditions, and implements programs and regulations required by law.

Clean Air Plan

The BAAQMD is responsible for developing a Clean Air Plan which guides the region’s air quality planning efforts to attain the CAAQS. The BAAQMD’s 2010 Clean Air Plan is the latest Clean Air Plan which contains district-wide control measures to reduce ozone precursor emissions (i.e., ROG and NO_X), particulate matter, and GHG emissions.

[2] California Air Resources Board, 2000. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*. October.
[3] California Air Resources Board, 2005. *Air Quality and Land Use Handbook: A Community Health Perspective.* April.

The Bay Area 2010 Clean Air Plan, which was adopted on September 15, 2010 by the BAAQMD's board of directors:

- Updates the Bay Area 2005 Ozone Strategy in accordance with the requirements of the California Clean Air Act to implement "all feasible measures" to reduce ozone;
- Provides a control strategy to reduce ozone, particulate matter (PM), air toxics, and greenhouse gases in a single, integrated plan;
- Reviews progress in improving air quality in recent years; and
- Establishes emission control measures to be adopted or implemented in the 2010 to 2012 timeframe.

BAAQMD CARE Program

The Community Air Risk Evaluation (CARE) program was initiated in 2004 to evaluate and reduce health risks associated with exposures to outdoor TACs in the Bay Area. The program examines TAC emissions from point sources, area sources, and on-road and off-road mobile sources with an emphasis on diesel exhaust, which is a major contributor to airborne health risk in California. The CARE program is an on-going program that encourages community involvement and input. The technical analysis portion of the CARE program is being implemented in three phases, which includes an assessment of the sources of TAC emissions, modeling and measurement programs to estimate concentrations of TAC, and an assessment of exposures and health risks. Throughout the program, information derived from the technical analyses will be used to focus emission reduction measures in areas with high TAC exposures and high density of sensitive populations. Risk reduction activities associated with the CARE program are focused on the most at-risk communities in the Bay Area. The BAAQMD has identified six communities as impacted: Concord, Richmond/San Pablo, Western Alameda County, San Jose, Redwood City/East Palo Alto, and Eastern San Francisco.

BAAQMD CEQA Air Quality Guidelines

The BAAQMD California Environmental Quality Act (CEQA) Air Quality Guidelines[4] were prepared to assist in the evaluation of air quality impacts of projects and plans proposed within the Bay Area. The guidelines provide recommended procedures for evaluating potential air impacts during the environmental review process consistent with CEQA requirements including thresholds of significance, mitigation measures, and background air quality information. They also include assessment methodologies for air toxics, odors, and GHG emissions. In June 2010, the BAAQMD's Board of Directors adopted CEQA thresholds of significance and an update of their CEQA Guidelines. In May 2011, the updated BAAQMD CEQA Air Quality Guidelines

[4] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines*. May.

were amended to include a risk and hazards threshold for new receptors and modify procedures for assessing impacts related to risk and hazard impacts.

On March 5, 2012, the Alameda County Superior Court issued a judgment finding that the BAAQMD had failed to comply with CEQA when it adopted the thresholds of significance in the 2011 BAAQMD CEQA Air Quality Guidelines. The court issued a writ of mandate ordering the BAAQMD to set aside the thresholds and cease dissemination of them until the BAAQMD complied with CEQA. In August 2013, the Appellate Court struck down the lower court's order to set aside the thresholds. However, this litigation remains pending as the California Supreme Court recently accepted a portion of California Building Industry Association's (CBIA) petition to review the appellate court's decision to uphold BAAQMD's adoption of the thresholds. The specific portion of the argument to be considered is in regard to whether CEQA requires consideration of the effects of the environment on a project (as contrasted to the effects of a proposed project on the environment).

EXISTING CLIMATE AND AIR QUALITY

Regional Air Quality

East Palo Alto is in the western portion of the San Francisco Bay Area Air Basin. The Air Basin includes the counties of San Francisco, Santa Clara, San Mateo, Marin, Napa, Contra Costa, and Alameda, along with the southeast portion of Sonoma County and the southwest portion of Solano County.

East Palo Alto is within the jurisdiction of the BAAQMD. Air quality conditions in the San Francisco Bay Area have improved significantly since the BAAQMD was created in 1955. Ambient concentrations of air pollutants, and the number of days during which the region exceeds air quality standards, have fallen dramatically. Exceedances of air quality standards occur primarily during meteorological conditions conducive to high pollution levels, such as cold, windless winter nights or hot, sunny summer afternoons.

Ozone levels, measured by peak concentrations and the number of days over the State 1-hour standard, have declined substantially in the San Francisco Bay Area as a result of aggressive programs by the BAAQMD and other regional, State, and federal agencies. The reduction of peak concentrations represents progress in improving public health; however, the Bay Area still exceeds the State standard for 1-hour ozone.

Levels of PM_{10} have exceeded State standards two of the last three years, and the area is considered a nonattainment area for this pollutant relative to the State standards. The Bay Area is an unclassified area for the federal PM_{10} standard. No exceedances of the State or federal CO standards have been recorded at any of the region's monitoring stations since 1991. The Bay Area is currently considered a maintenance area for State and federal CO standards.

Local Climate and Air Quality

Air quality is a function of both local climate and local sources of air pollution. Air quality is the balance of the natural dispersal capacity of the atmosphere and emissions of air pollutants from human uses of the environment. Climate and topography are major influences on air quality in the project area.

Climate and Meteorology

The climate of East Palo Alto is characterized by warm, dry summers and cool, moist winters. The proximity of the San Francisco Bay and Pacific Ocean has a moderating influence on the local climate. East Palo Alto is located in the Peninsula climate subregion of the Bay Area.

The major large-scale weather feature controlling the area's climate is a large high pressure system located in the eastern Pacific Ocean, known as the Pacific High. The strength and position of the Pacific High varies seasonally. It is strongest during summer and located off the west coast of the United States. Large-scale atmospheric subsidence associated with the Pacific High produces an elevated temperature inversion along the West Coast. The base of this inversion is usually located from 1,000 to 3,000 feet above mean sea level, depending on the intensity of subsidence and the prevailing weather condition. Vertical mixing is often limited to the base of the inversion, trapping air pollutants in the lower atmosphere. Marine air trapped below the base of the inversion is often condensed into fog or stratus clouds by the cool Pacific Ocean. This condition is typical of the warmer months of the year from roughly May through October. Stratus-type clouds usually form offshore and move into the Bay Area during the evening hours. Stratus clouds also form over the San Francisco Bay during the evening hours. Stratus cover over the Peninsula, including East Palo Alto, is common during late night and early morning hours. As the land warms the following morning, the clouds often dissipate. The stratus cover then redevelops and moves inland late in the day along with an increase in winds. Otherwise, clear skies and dry conditions prevail during summer.

As winter approaches, the Pacific High becomes weaker and shifts south, allowing weather systems associated with the polar jet stream to affect the region. Low pressure systems produce periods of cloudiness, strong shifting winds, and precipitation. The number of days with precipitation can vary greatly from year to year, resulting in a wide range of annual precipitation totals. Precipitation is generally lowest along the Bay, with much higher amounts occurring along south- and west-facing mountain slopes that are west of East Palo Alto. East Palo Alto, which lies on the lee side of the coastal mountains in southern San Mateo County, receives about 15 to 20 inches of precipitation. Mountains to the west receive 30 to 40 inches. Most rainfall occurs from November through April. High-pressure systems are also common in winter with low-level inversions that trap produce cool stagnant conditions. Radiation fog and haze trapped near the surface are common during extended winter periods where high-pressure systems influence the weather.

The proximity of the eastern Pacific High and relatively lower pressure inland produces a prevailing westerly sea breeze along the central and northern California coast for most of the year. As this wind is channeled through the Golden Gate and other topographical gaps to the west, it branches off to the northeast and southeast, following the general orientation of the San Francisco Bay system. Marine air penetrates the eastern Peninsula mainly from the northwest and through gaps in the lower mountains. The prevailing wind in most of East Palo Alto is primarily from a northwest direction, especially during spring and summer. In winter, winds become variable with more of a southeasterly orientation. Nighttime winds and land breezes during the colder months of the year prevail with variable drainage out of the mountainous areas. Wind speeds are highest during the spring and early summer and lightest in fall. Winter storms bring relatively short episodes of strong southerly winds.

Temperatures in East Palo Alto tend to be less extreme compared to inland locations due to the moderating effect of the Pacific Ocean and the Bay. In summer, high temperatures are generally in the high 70s and in the 50s during winter. Low temperatures range from the 50s in summer to the 30s in winter.

Air Pollution Potential

East Palo Alto can experience episodes of elevated particulate levels in late fall and winter, when the Pacific High can combine with high pressure over the interior regions of the western United States (known as the Great Basin High) to produce extended periods of light winds and low-level temperature inversions. Although less common, this pattern in summer can produce fair weather and very warm temperatures throughout the Bay Area. This condition frequently produces poor atmospheric mixing that results in degraded regional air quality. Ozone standards traditionally are exceeded in downwind portions of the Bay Area when this condition occurs during the warmer months of the year. Emissions from most of the Bay Area, including East Palo Alto, contribute to O_3 ambient air quality violations that occur on up to about 20 days per year.

Existing Air Pollutant Levels

BAAQMD monitors air pollution at various sites within the Bay Area. The closest official monitoring station to East Palo Alto is located in Redwood City at 897 Barron Avenue, near Highway 101. While the air quality conditions measured at BAAQMD’s Redwood City monitoring station are not identical to conditions in East Palo Alto, no other official monitoring station is closer to the Plan Area. Pollutant monitoring results for the years 2010 to 2014 at the Redwood City ambient air quality monitoring station are shown in Table 3.

TABLE 3. Ambient Air Quality at the Redwood City Monitoring Station

Pollutant	Average Time	Measured Air Pollutant Levels				
		2010	2011	2012	2013	2014
Ozone (O_3)	1-Hour	**0.113 ppm**	0.076 ppm	0.063 ppm	0.083 ppm	0.086 ppm
	8-Hour	**0.077 ppm**	0.062 ppm	0.055 ppm	**0.076 ppm**	0.066 ppm
Carbon Monoxide (CO)	8-Hour	1.7 ppm	1.7 ppm	1.8 ppm	ND	ND
Nitrogen Dioxide (NO_2)	1-Hour	0.059 ppm	0.056 ppm	0.060 ppm	0.054 ppm	0.055 ppm
	Annual	0.012 ppm	0.012 ppm	0.011 ppm	0.012 ppm	0.011 ppm
Respirable Particulate Matter (PM_{10})	24-Hour	ND	ND	ND	ND	ND
	Annual	ND	ND	ND	ND	ND
Fine Particulate Matter ($PM_{2.5}$)	24-Hour	**36.5 $\mu g/m^3$**	**39.7 $\mu g/m^3$**	34.3 $\mu g/m^3$	**39.0 $\mu g/m^3$**	35.0 $\mu g/m^3$
	Annual	8.3 $\mu g/m^3$	8.7 $\mu g/m^3$	8.5 $\mu g/m^3$	10.7 $\mu g/m^3$	7.2 $\mu g/m^3$

Source: CARB, iADAM Air Quality Statistics, see http://www.arb.ca.gov/adam/.
Note: ppm = parts per million and $\mu g/m^3$ = micrograms per cubic meter
Values reported in **bold** exceed ambient air quality standard
ND = No Data available.

GREENHOUSE GASES

Global temperatures are affected by naturally occurring and anthropogenic-generated (generated by humankind) atmospheric gases, such as water vapor, carbon dioxide, methane, and nitrous oxide. Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Solar radiation enters the earth's atmosphere from space, and a portion of the radiation is absorbed at the surface. The earth emits this radiation back toward space as infrared radiation. Greenhouse gases, which are mostly transparent to incoming solar radiation, are effective in absorbing infrared radiation and redirecting some of this back to the earth's surface. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This is known as the greenhouse effect. The greenhouse effect helps maintain a habitable climate. Emissions of GHGs from human activities, such as electricity production, motor vehicle use, and agriculture, are elevating the concentration of GHGs in the atmosphere, and are reported to have led to a trend of unnatural warming of the earth's natural climate, known as global warming or global climate change. The term "global climate change" is often used interchangeably with the term "global warming," but "global climate change" is preferred because it implies that there are other consequences to the global climate in addition to rising temperatures. Other than water vapor, the primary GHGs contributing to global climate change include the following gases:

- Carbon dioxide (CO_2), primarily a byproduct of fuel combustion;
- Nitrous oxide (N_2O), a byproduct of fuel combustion; also associated with agricultural operations such as the fertilization of crops;
- Methane (CH_4), commonly created by off-gassing from agricultural practices (e.g. livestock), wastewater treatment and landfill operations;
- Chlorofluorocarbons (CFCs) were used as refrigerants, propellants and cleaning solvents, but their production has been mostly prohibited by international treaty;
- Hydrofluorocarbons (HFCs) are now widely used as a substitute for chlorofluorocarbons in refrigeration and cooling; and
- Perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) emissions are commonly created by industries such as aluminum production and semiconductor manufacturing.

These gases vary considerably in terms of Global Warming Potential (GWP), a term developed to compare the propensity of each GHG to trap heat in the atmosphere relative to another GHG. GWP is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and the length of time of gas remains in the atmosphere. The GWP of each GHG is measured relative to CO_2. Accordingly, GHG emissions are typically measured and reported in terms of equivalent CO_2 (CO_2e). For instance, SF_6 is 22,800 times more intense in terms of global climate change contribution than CO_2.

An expanding body of scientific research supports the theory that global climate change is currently affecting changes in weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, and that it will increasingly do so in the future. The climate and several naturally-occurring resources within California could be adversely affected by the global warming trend. Increased precipitation and sea level rise could increase coastal flooding, saltwater intrusion, and degradation of wetlands. Mass migration and/or loss of plant and animal species could also occur. Potential effects of global climate change that could adversely affect human health include more extreme heat waves and heat-related stress; an increase in climate-sensitive diseases; more frequent and intense natural disasters such as flooding, hurricanes, and drought; and increased levels of air pollution.

Greenhouse Gas Emissions Regulatory Framework

This section summarizes key federal, State, and City statutes, regulations, and policies that would apply to the Plan Area. At each level, agencies are considering strategies to control emissions of gases that contribute to global climate change.

Federal Regulations

The United States participates in the United Nations Framework Convention on Climate Change (UNFCCC). While the United States signed the Kyoto Protocol, which would have required reductions in GHGs, Congress never ratified the protocol. The federal government chose voluntary and incentive-based programs to reduce emissions and has established programs to promote climate technology and science.

On April 2, 2007, the United States Supreme Court ruled that the EPA has the authority to regulate CO_2 emissions under the federal CAA, and on December 7, 2009, the EPA Administrator signed a final action under the CAA, finding that six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) constitute a threat to public health and welfare, and that the combined emissions from motor vehicles cause and contribute to global climate change.

On April 1, 2010, the EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced a final joint rule to establish a national program consisting of new standards for model year 2012 through 2016 light-duty vehicles that will reduce GHG emissions and improve fuel economy.

On May 13, 2010, the EPA issued a final rule to address GHG emissions from stationary sources under the CAA permitting programs. This final rule sets thresholds for GHG emissions that define when permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing industrial facilities.

At this time, there are no federal regulations or policies directly pertaining to assessing GHG emissions from the General Plan Update under CEQA.

State Regulations

The State of California is concerned about GHG emissions and their effect on global climate change. The State recognizes that "there appears to be a close relationship between the concentration of GHGs in the atmosphere and global temperatures" and that "the evidence for climate change is overwhelming." The effects of climate change on California, in terms of how it would affect the ecosystem and economy, remain uncertain. The State has many areas of concern regarding climate change with respect to global warming. According to the 2006 Climate Action Team Report, the following climate change effects and conditions can be expected in California over the course of the next century:

- A diminishing Sierra snowpack declining by 70 to 90 percent, effecting the State's water supply;
- Increasing temperatures from 8 to 10.4 degrees °F under the higher emission scenarios, leading to a 25 to 35 percent increase in the number of days ozone pollution standards are exceeded in most urban areas;
- Coastal erosion along the length of California and seawater intrusion into the Sacramento River Delta from a 4- to 33-inch rise in sea level. This would exacerbate flooding in already vulnerable regions;
- Increased vulnerability of forests due to pest infestation and increased temperatures;
- Increased challenges for the State's important agricultural industry from water shortages, increasing temperatures, and saltwater intrusion into the Delta; and
- Increased electricity demand, particularly in the hot summer months.

Assembly Bill 1575 (1975). In 1975, the Legislature created the California Energy Commission (CEC). The CEC regulates electricity production that is one of the major sources of GHGs.

Title 24, Part 6 of the California Code of Regulations (1978). The Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods.

Assembly Bill 1493 (2002). Assembly Bill (AB) 1493 required CARB to develop and adopt regulations that reduce GHG emitted by passenger vehicles and light duty trucks.

State of California Executive Order S-3-05 (2005). The Governor's Executive Order established aggressive emissions reductions goals: by 2010, GHG emissions must be reduced to 2000 levels; by 2020, GHG emissions must be reduced to 1990 levels; and by 2050, GHG emissions must be reduced to 80 percent below 1990 levels.

In June 2005, the Governor of California signed Executive Order S-3-05, which identified California EPA as the lead coordinating State agency for establishing climate change emission reduction targets in California. A "Climate Action Team," a multi-agency group of State agencies, was set up to implement Executive Order S-3-05. Under this order, the State plans to reduce GHG emissions to 80 percent below 1990 levels by 2050. GHG emission reduction strategies and measures to reduce global warming were identified by the California Climate Action Team in 2006.

Assembly Bill 32 (AB 32), California Global Warming Solutions Act (2006). AB 32, the Global Warming Solutions Act of 2006, codifies the State's GHG emissions target by directing CARB to reduce the State's global warming emissions to 1990 levels by 2020. AB 32 was signed and passed into law by Governor Schwarzenegger on September 27, 2006. Since that time, the CARB, CEC, California Public Utilities Commission (CPUC), and Building Standards Commission have all been developing regulations that will help meet the goals of AB 32 and Executive Order S-3-05.

A Scoping Plan for AB 32 was adopted by CARB in December 2008. It contains the State's main strategies to reduce GHGs from business-as-usual emissions projected in 2020 back down to 1990 levels. Business-as-usual (BAU) is the projected emissions in 2020, including increases in emissions caused by growth, without any GHG reduction measures. The Scoping Plan has a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

As directed by AB 32, CARB has also approved a statewide GHG emissions limit. On December 6, 2007, CARB staff resolved an amount of 427 million metric tons of equivalent carbon dioxide (MMT CO_2e) as the total statewide GHG 1990 emissions level and 2020 emissions limit. The limit is a cumulative statewide limit, not a sector- or facility-specific limit. CARB updated the future 2020 BAU annual emissions forecast, in light of the economic downturn, to 545 MMT of CO2e. Two GHG emissions reduction measures currently enacted that were not previously included in the 2008 Scoping Plan baseline inventory were included, further reducing the baseline inventory to 507 MMT of CO2e. Thus, an estimated reduction of 80 MMT of CO2e is necessary to reduce statewide emissions to meet the AB 32 target by 2020. In May of 2015, Governor Jerry Brown issued an emissions reduction target of 40 percent below 1990 levels by 2030.

Senate Bill 375 (SB 375), California's Regional Transportation and Land Use Planning Efforts (2008). California enacted legislation SB 375 to expand the efforts of AB 32 by controlling indirect GHG emissions caused by urban sprawl. SB 375 would develop emissions-reduction goals in which regions can apply in planning activities. SB 375 provides incentives for local governments and developers to implement new conscientiously planned growth patterns. This includes incentives for creating attractive, walkable, and sustainable communities and revitalizing existing communities. The legislation also allows developers to bypass certain environmental reviews under CEQA if they build projects consistent with the new sustainable community strategies. Development of more alternative transportation options that would reduce vehicle trips and miles traveled, along with traffic congestion, would be encouraged. SB 375 enhances CARB's ability to reach the AB 32 goals by directing the agency in developing regional GHG emission reduction targets to be achieved from the transportation sector for 2020 and 2035. CARB would work with the metropolitan planning organizations (e.g. Association of Bay Area Governments [ABAG] and Metropolitan Transportation Commission [MTC]) to align their regional transportation, housing, and land use plans to reduce vehicle miles traveled and demonstrate the region's ability to attain its GHG reduction targets. A similar process is used to reduce transportation emissions of ozone precursor pollutants in the Bay Area.

Executive Order S-13-08 (2008). This Executive Order directed California agencies to assess and reduce the vulnerability of future construction projects to impacts associated with sea-level rise.

Bay Area Air Quality Management District

BAAQMD is the regional government agency that regulates sources of air pollution within the nine San Francisco Bay Area counties. The BAAQMD regulates GHG emissions through the following plans, programs, and guidelines.

Regional Clean Air Plans. BAAQMD and other air districts prepare clean air plans in accordance with the State and Federal Clean Air Acts. The Bay Area 2010 Clean Air Plan is a comprehensive plan to improve Bay Area air quality and protect public health through implementation of a control strategy designed to reduce emissions and ambient concentrations of harmful pollutants. The most recent Clean Air Plan also includes measures designed to reduce GHG emissions.

BAAQMD Climate Protection Program. The BAAQMD established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the San Francisco Bay Area Air Basin. The climate protection program includes measures that promote energy efficiency, reduce vehicle miles traveled, and develop alternative sources of energy, all of which assist in reducing emissions of GHG and in reducing air pollutants that affect the health of residents. BAAQMD also seeks to support current climate protection programs in the region and to stimulate additional efforts through public education and outreach, technical assistance to local governments and other interested parties, and promotion of collaborative efforts among stakeholders.

BAAQMD CEQA Air Quality Guidelines. The BAAQMD adopted revised CEQA Air Quality Guidelines on June 2, 2010 and then adopted a modified version of the Guidelines in May, 2011. The BAAQMD CEQA Air Quality Guidelines include thresholds of significance for GHG emissions.[5] Under the latest CEQA Air Quality Guidelines, a local government may prepare a qualified GHG Reduction Strategy that is consistent with AB 32 goals. If a project is consistent with an adopted qualified GHG Reduction Strategy and General Plan that addresses the project's GHG emissions, it can be presumed that the project will not have significant GHG emissions under CEQA.[6] The BAAQMD also developed a quantitative threshold for project- and plan-level analyses based on estimated GHG emissions, as well as per capita metrics.

City of East Palo Alto Climate Action Plan

The City of East Palo Alto finalized a Climate Action Plan in December, 2011.[7] The Climate Action Plan presents goals and measures for reducing the City's GHG emissions. A 2005 emissions inventory for community-wide GHG emissions equaled 140,465 metric tons (MT) of CO_2e, with emissions from transportation constituting the single largest source in the City at about 63 percent. To achieve the City's goals, the Climate Action Plan developed objectives and strategies in transportation, energy, solid waste, recycling, water conservation, and carbon sequestration.

PROJECT IMPACTS AND MITIGATION MEASURES

Significance Criteria

Per Appendix G of the CEQA Guidelines and BAAQMD recommendations, air quality impacts are considered significant if implementation of the General Plan Update would:

1) Conflict with or obstruct implementation of an applicable air quality plan;
2) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);
3) Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
4) Expose sensitive receptors to substantial pollutant concentrations;
5) Create objectionable odors affecting a substantial number of people;
6) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or

[5] On March 5, 2012, the Alameda County Superior Court issued a judgment finding that the BAAQMD had failed to comply with CEQA when it adopted the thresholds of significance in the 2011 BAAQMD *CEQA Air Quality Guidelines*. The court issued a writ of mandate ordering the BAAQMD to set aside the thresholds and cease dissemination of them until the BAAQMD complied with CEQA. The First District of the California Court of Appeal reversed this earlier judgment in August 2013. However, this litigation remains pending as the California Supreme Court recently accepted a portion of CBIA's petition to review the appellate court's decision to uphold BAAQMD's adoption of the thresholds.

[6] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines*. May.

[7] City of East Palo Alto, 2011. *City of East Palo Alto Final Climate Action Plan*. December.

7) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

The BAAQMD adopted CEQA Guidelines in June 2010, which were revised in May 2011. Methodology and thresholds for criteria air pollutant impacts and community health risk, as set forth in the BAAQMD Guidelines, are utilized in this analysis.

The following screening thresholds and significance criteria would be applicable to the General Plan Update.

Consistency with Clean Air Planning Efforts

According to the BAAQMD Air Quality Guidelines, proposed plans must show over the planning period of the plan that:

- The plan incorporates current air quality plan control measures as appropriate to the plan area; and
- The rate of increase in vehicle miles traveled or vehicle trips (either measure may be used) within the plan area is equal to or lower than the rate of increase in population projected for the proposed plan.

Construction and Operation Emissions

The BAAQMD Air Quality Guidelines do not have thresholds related to direct and indirect criteria pollutant emissions resulting from plan implementation. Traffic resulting from the implementation of the plan would cause a significant local air quality impact if emissions of CO cause a projected exceedance of the ambient CO State standard of 9.0 parts per million (ppm) for 8-hour averaging period. This would be considered to cause or contribute substantially to an existing or projected air quality violation.

Exposure of New Residences to Toxic Air Contaminants

Unlike industrial or stationary sources of air pollution, residential development and other development where sensitive receptors would be located do not require air quality permits. Nonetheless, this type of development can expose people to unhealthy conditions. The BAAQMD Air Quality Guidelines Thresholds of Significance for plans with regard to community risk and hazard impacts are:

- Identify special overlay zones around existing and planned sources of TACs and PM (including adopted risk reduction plan areas), and special overlay zones on each side of all freeways and high-volume roadways; and
- The plan must also identify goals, policies, and objectives to minimize potential impacts and create overlay zones around sources of TACs, PM, and hazards.

Odors

Odors are assessed based on the potential of the Plan to result in odor complaints. The BAAQMD Air Quality Guidelines Thresholds of Significance for plans with regard to odor impacts are:

- Identify special overlay zones around existing and planned sources of odors; and
- The plan must identify goals, policies, and objectives to minimize potential impacts and create buffer distances between sources of odors and receptors.

Greenhouse Gas Emissions

The BAAQMD thresholds were developed specifically for the Bay Area after considering the latest Bay Area GHG inventory and the effects of AB 32 scoping plan measures that would reduce regional emissions. BAAQMD intends to achieve GHG reductions from new land use developments to close the gap between projected regional emissions with AB 32 scoping plan measures and the AB 32 targets. The BAAQMD GHG recommendations include a general plan-level GHG emission efficiency metric of 6.6 MT of CO_2e per year per capita (future residences and full-time workers). Plans that have emissions below 6.6 MT of CO_2e per year per capita are considered to have less-than-significant GHG emissions.

Impact 1: Conflict with or obstruct implementation of an applicable air quality plan?

The BAAQMD is the regional agency responsible for overseeing compliance with State and federal laws, regulations, and programs within the San Francisco Bay Area Air Basin. The BAAQMD, with assistance from ABAG and MTC, has prepared and implements specific plans to meet the applicable laws, regulations, and programs. The most recent and comprehensive of which is the *Bay Area 2010 Clean Air Plan*.[8] The BAAQMD has also developed CEQA guidelines to assist lead agencies in evaluating the significance of air quality impacts. In formulating compliance strategies, BAAQMD relies on planned land uses established by local general plans. Land use planning affects vehicle travel, which in turn affects region-wide emissions of air pollutants and GHG.

[8] Bay Area Air Quality Management District (BAAQMD), 2010. *Bay Area 2010 Clean Air Plan*.

The General Plan Update would result in an estimated additional 7,361 residents between 2015 and 2040. Daily vehicle miles traveled (VMT) for 2015 and 2040 were from the project traffic consultant. Table 4 identifies the VMT and population for the General Plan Update. Using 2015 as a baseline year, VMT attributable to the General Plan Update is anticipated to increase 35 percent. The increase in population is estimated to be 25 percent. As a result, VMT would increase at a higher rate than population with implementation of the General Plan Update and this impact would be considered **significant**.

TABLE 4. Summary of Existing and Future Vehicle Miles Traveled and Service Population

Metric/ Variable	2015	2040 GP Build-Out	Increase with GP Update
VMT	397,322	535,274	35%
Population	30,017	37,378	25%

Source: Kittelson & Associates, 2016.

Consistency of the General Plan Update with Clean Air Plan control measures is demonstrated by assessing whether the proposed Plan implements all of the applicable Clean Air Plan control measures. The 2010 Clean Air Plan includes about 55 control measures that are intended to reduce air pollutant emissions in the Bay Area either directly or indirectly. The control measures are divided into five categories that include:

- 18 Measures to reduce stationary and area sources;
- 10 Mobile source measures;
- 17 Transportation control measures;
- Six land use and local impact measures; and
- Four energy and climate measures.

In developing the control strategy, BAAQMD identified the full range of tools and resources available, both regulatory and non-regulatory, to develop each measure. Implementation of each control measure will rely on some combination of the following:

- Adoption and enforcement of rules to reduce emissions from stationary sources, area sources, and indirect sources;
- Revisions to the BAAQMD's permitting requirements for stationary sources;
- Enforcement of CARB rules to reduce emissions from heavy-duty diesel engines;
- Allocation of grants and other funding by the Air District and/or partner agencies;
- Promotion of best policies and practices that can be implemented by local agencies through guidance documents, model ordinances, and other measures;

- Partnerships with local governments, other public agencies, the business community, non-profits, and other groups;
- Public outreach and education;
- Enhanced air quality monitoring;
- Development of land use guidance and CEQA guidelines, and Air District review and comment on Bay Area projects pursuant to CEQA; and
- Leadership and advocacy.

This approach relies upon lead agencies to assist in implementing some of the control measures. A key tool for local agency implementation is the development of land use policies and implementing measures that address new development or redevelopment in local communities. The consistency of the General Plan Update is evaluated with respect to each set of control measures.

Stationary and Area Source Control Measures

The Clean Air Plan includes Stationary Source Control measures that BAAQMD adopts as rules or regulations through their authority to control emissions from stationary and area sources. The BAAQMD is the implementing agency, since these control measures are applicable to sources of air pollution that must obtain District permits. The City uses BAAQMD's CEQA Air Quality Guidelines to evaluate air pollutant emissions from new sources.

Mobile Source Measures

The Clean Air Plan includes Mobile Source Measures that would reduce emissions by accelerating the replacement of older, dirtier vehicles and equipment through programs such as the BAAQMD's Vehicle Buy-Back and Smoking Vehicle Programs, and promoting advanced technology vehicles that reduce emissions. The implementation of these measures rely heavily upon incentive programs, such as the Carl Moyer Program and the Transportation Fund for Clean Air, to achieve voluntary emission reductions in advance of, or in addition to, CARB requirements. CARB has new regulations that require the replacement or retrofit of on-road trucks, construction equipment, and other specific equipment that is diesel powered.

Transportation Control Measures (TCMs)

The Clean Air Plan includes transportation control measures (TCMs) that are strategies meant to reduce vehicle trips, vehicle use, VMT, vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions. While most of the TCMs are implemented at the regional level (that is, by MTC or the California Department of Transportation [Caltrans]), there are measures that the Clean Air Plan relies upon local communities to assist with implementation. In addition, the Clean Air Plan includes land use measures and energy and climate measures whose implementation is aided by proper land use planning decisions.

The policies contained in the General Plan Update would generally be consistent with Clean Air Plan measures intended to reduce automobile use and are discussed below. Table 5 lists the relevant Clean Air Plan policies to the General Plan Update and indicates consistency or non-consistency with the policies.

TABLE 5. BAAQMD Control Strategy Measures

BAAQMD Control Strategy Measures	Consistency
Transportation Control Measures	
TCM B-2: Improve Transit Efficiency	Consistent While this is mostly a regionally implemented TCM, see Draft Policies LU-1.77, T-1.4, and Goal T.5
TCM B-4: Goods Movement	Consistent This is primarily a regional measure; however, see Draft Policy HE-1.52
TCM C-1: Support Voluntary Employer-Based Trip Reduction Program	Consistent See Draft Policy T-1.34
TCM C-2: Safe Routes to School and Safe Routes to Transit	Consistent See Draft Policies T-1.3, and Goals HE-18 and HE-19
TCM C-3: Promote Rideshare Services and Incentives	Consistent See Draft Policy T-1.34
TCM C-4: Conduct Public Outreach	Consistent While this is mostly a regionally implemented TCM, see Draft Policies T-1.12, OS-1.31, PIC-1.47, and Goal PIC-10
TCM C-5: Promote Smart Driving/Speed Moderation	Consistent See Draft Policies LU-1.151, -I.187, and T-1.2
TCM D-1: Improve Bicycle Access and Facilities	Consistent See Draft Policies LU-1.170, T-1.4, and Goal T-4
TCM D-2: Improve Pedestrian Access and Facilities	Consistent See Draft Policies LU-1.53, -1.63, -1.69, -1.70, -1.73, T-1.4, and -1.10
TCM D-3: Support Local Land Use Strategies	Consistent See Draft Policies LU-1.5, -1.9, -1.39, -1.40, and -1.80

BAAQMD Control Strategy Measures	Consistency
TCM E-2: Parking Pricing and Management Strategies	Consistent See Draft Policies LU-1.37, -1.54, T-1.28, -1.29, and -1.31
Land Use and Local Impact Control Measures	
LUM 1: Goods Movement	Consistent While this is primarily a statewide and regional measure, see Draft Policy HE-1.52
LUM 3: Enhanced CEQA Program	Consistent While this TCM addresses BAAQMD actions, the City requires appropriate air quality evaluation of projects during CEQA review using the BAAQMD CEQA Air Quality Guidelines
LUM 5: Reduce Risk in Impacted Communities	This issue is addressed in this EIR, in which the impact of existing or new TAC sources upon sensitive receptors is evaluated and mitigation measures to reduce any substantial TAC exposures are identified; Also see Goal HE-9
Energy and Climate Measures	
ECM 1: Energy Efficiency	Consistent See Draft Policies LU-1.21, -1.47, PIC-1.50, -1.51, -1.52, and Goal PIC-7
ECM 2: Renewable Energy	Consistent See Draft Policy 1.42
ECM 3: Urban Heat Island Mitigation	Consistent See Draft Policies OS-1.31 and PIC-1.44
ECM 4: Tree-Planting	Consistent See Draft Policies LU-1.32, -1.71, -1.72, and OS-1.29

As indicated in Table 5, the plan would include features, policies, and implementing measures that are generally consistent with the Clean Air Plan control measures. However, as discussed above, VMT would increase at a higher rate than population with implementation of the General Plan Update, which would lead to greater regional emissions of non-attainment air pollutants (or their precursors) than assumed in the latest Air Quality Plan. Therefore, this impact would be considered **significant**.

Mitigation Measure AQ-1: There are no measures available to mitigate this impact related to inconsistency with the Clean Air Plan.

Significance After Mitigation: As there are no available mitigation measures, the impact would remain ***significant and unavoidable***.

Impact 2: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or State ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

Implementation of the General Plan Update would result in short-term emissions from construction activities associated with subsequent development, including site grading, asphalt paving, building construction, and architectural coating. Emissions commonly associated with construction activities include fugitive dust from soil disturbance, fuel combustion from mobile heavy-duty diesel- and gasoline-powered equipment, portable auxiliary equipment, and worker commute trips. During construction, fugitive dust, the dominant source of PM_{10} and $PM_{2.5}$ emissions, is generated when wheels or blades disturb surface materials. Uncontrolled dust from construction can become a nuisance and potential health hazard to those living and working nearby. The potential health risk impact from construction is addressed in Impact 4.

Demolition and renovation of buildings can also generate PM_{10} and $PM_{2.5}$ emissions. Off-road construction equipment is often diesel-powered and can be a substantial source of NO_X emissions, in addition to PM_{10} and $PM_{2.5}$ emissions. Worker commute trips and architectural coatings are dominant sources of ROG emissions. The BAAQMD CEQA Air Quality Guidelines do not identify plan level thresholds that apply to construction. Although construction activities at individual project sites are expected to occur during a relatively short time period, the combination of temporary dust from activities and diesel exhaust from construction equipment poses both a health and nuisance impact to nearby receptors. In addition, NO_X emissions during grading and soil import/export for large projects may exceed the BAAQMD NO_X emission thresholds. Without application of appropriate control measures to reduce construction dust and exhaust, construction period impacts would be considered a **potentially significant impact**. Implementation of Mitigation Measure AQ-2 would reduce this impact to less than significant in most cases. However, it is not possible to ensure that very large construction projects could be mitigated to a level of less than significant. Therefore, this impact would remain **significant and unavoidable**.

Mitigation Measure AQ-2: Implement BAAQMD-Recommended Measures to Control Particulate Matter Emissions during Construction. Measures to reduce diesel particulate matter (DPM) and PM_{10} from construction are recommended to ensure that short-term health impacts to nearby sensitive receptors are avoided.

Dust (PM_{10}) Control Measures:

- Water all active construction areas at least twice daily and more often during windy periods. Active areas adjacent to residences should be kept damp at all times.
- Cover all hauling trucks or maintain at least two feet of freeboard.
- Pave, apply water at least twice daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas.
- Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas and sweep streets daily (with water sweepers) if visible soil material is deposited onto the adjacent roads.
- Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (i.e., previously-graded areas that are inactive for 10 days or more).
- Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles.
- Limit traffic speeds on any unpaved roads to 15 mph.
- Replant vegetation in disturbed areas as quickly as possible.
- Suspend construction activities that cause visible dust plumes to extend beyond the construction site.
- Post a publically visible sign(s) with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Additional measures to reduce exhaust emissions from large construction projects:

- The developer or contractor shall provide a plan for approval by the City or BAAQMD demonstrating that the heavy-duty (>50 horsepower) off-road vehicles to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project wide fleet-average 20 percent NO_X reduction and 45 percent particulate reduction compared to the most recent CARB fleet average for the year 2011.
- Clear signage at all construction sites will be posted indicating that diesel equipment standing idle for more than five minutes shall be turned off. This would include trucks waiting to deliver or receive soil, aggregate, or other bulk materials. Rotating drum concrete trucks could keep their engines running continuously as long as they were onsite or adjacent to the construction site.
- The contractor shall install temporary electrical service whenever possible to avoid the need for independently powered equipment (e.g. compressors).
- Properly tune and maintain equipment for low emissions.

Additionally, implementation of the General Plan Update would result in long-term area and mobile source emissions from operation and use of subsequent development. Implementation of the General Plan Update could include stationary sources of pollutants that would be required to obtain permits to operate in compliance with BAAQMD rules. These sources include, but are not limited to, gasoline stations, dry cleaners, internal combustion engines, and surface coating operations. The permit process ensures that these sources would be equipped with the required emission controls and that, individually, these sources would result in a less than significant impact.

As discussed above, the BAAQMD Air Quality Guidelines do not have thresholds related to direct and indirect regional criteria pollutant emissions resulting from plan implementation. The BAAQMD CEQA Air Quality Guidelines only require emissions computations for project-level analysis. From a planning standpoint, the impact of operational criteria pollutant emissions would be considered **significant**, since the General Plan Update would cause significant increases in VMT compared to population growth.

Impact 3: Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

Monitoring data from all ambient air quality monitoring stations in the Bay Area indicate that existing carbon monoxide levels are currently below national and California ambient air quality standards. Monitored CO levels have decreased substantially since 1990 as newer vehicles with greatly improved exhaust emission control systems have replaced older vehicles. The Bay Area has been designated as an attainment area for the CO standards. The highest measured levels in Concord (the closest monitoring stations to the Planning Area) during the past three years are 0.82 ppm for 8-hour averaging periods, compared with State and federal criteria of 9.0 ppm.

Even though current CO levels in the Bay Area are well below ambient air quality standards, and there have been no exceedances of CO standards in the Bay Area since 1991, elevated levels of CO still warrant analysis. CO hotspots (occurrences of localized high CO concentrations) could still occur near busy congested intersections. Recognizing the relatively low CO concentrations experienced in the Bay Area, the BAAQMD's CEQA Air Quality Guidelines state that a project would have a less-than-significant impact if it would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour. 2040 General Plan peak hour traffic volumes would be far less. Since intersections affected by the project would have volumes less than the threshold of 44,000 vehicles per hour, the impact of the project related to localized CO concentrations would therefore be **less than significant**.

Impact 4: Expose sensitive receptors to substantial pollutant concentrations?

Subsequent land use activities associated with implementation of the General Plan Update could potentially include short-term construction sources of TACs and long-term operational sources of TACs, including stationary and mobile sources.

Temporary Construction Sources

Implementation of the General Plan Update would result in the potential construction of a variety of projects. This construction would result in short-term emissions of DPM, a TAC. Construction would result in the generation of DPM emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities. The amount to which the receptors are exposed (a function of concentration and duration of exposure) is the primary factor used to determine health risk (i.e., potential exposure to TAC emission levels that exceed applicable standards). Health-related risks associated with diesel-exhaust emissions are primarily linked to long-term exposure and the associated risk of contracting cancer. The calculation of cancer risk associated with exposure to TACs is typically based on a long-term exposure (e.g., 30- or 70-year period). The use of diesel-powered construction equipment, however, would be temporary and episodic and would occur over a relatively large area. Cancer risk and $PM_{2.5}$ exposure would have to be analyzed through project-level analysis to identify the potential for significant impacts and measures to reduce those impacts to less than significant. Health risks associated with temporary construction would, therefore, be considered **potentially significant**. Implementation of Mitigation Measure AQ-3 would reduce this impact to less than significant in most cases. However, it is not possible to ensure that very large construction projects could be mitigated to a level of less than significant. Therefore, this impact would remain **significant and unavoidable**.

Mitigation Measure AQ-3 **Require Project-Level Construction Health Risk Assessment.** Construction health risk assessment will be required on a project-by-project basis, either through screening or refined modeling, to identify impacts and, if necessary, include measures to reduce exposure. Reduction in health risk can be accomplished through, though is not limited to, the following measures:

- Construction equipment selection;
- Use of alternative fuels, engine retrofits, and added exhaust devices;
- Modify construction schedule; and
- Implementation of BAAQMD Basic and/or Additional Construction Mitigation Measures for control of fugitive dust.

Long-Term Operational Sources

According to the BAAQMD CEQA Air Quality Guidelines, for a plan to have a less-than-significant impact with respect to TACs, overlay zones must be established around existing and proposed land uses that would emit these air pollutants. Overlay zones to avoid TAC impacts must be reflected in local plan policies, land use maps, or implementing ordinances.

The BAAQMD CEQA Air Quality Guidelines consider exposure of sensitive receptors to air pollutant levels that result in an unacceptable cancer risk or hazard, to be significant. For cancer risk, which is a concern with DPM and other mobile-source TACs, the BAAQMD Risk Management Policy considers an increased risk of contracting cancer that is 10 in one million chances or greater, to be significant risk for a single source. The BAAQMD CEQA Guidelines also consider exposure to annual $PM_{2.5}$ concentrations that exceed 0.3 micrograms per cubic meter ($\mu g/m^3$) to be significant. Non-cancer risk would be considered significant if the computed Hazard Index is greater than 1.0.[9] For cumulative sources, the BAAQMD CEQA Guidelines consider 100 in one million excess cancer risk, $PM_{2.5}$ concentrations that exceed 0.8 $\mu g/m^3$, and non-cancer Hazard Index greater than 10.0 to be significant.

The General Plan Update would permit and facilitate the development of new sensitive receptors, such as new homes, in locations near arterial and collector roadways, highways, and stationary sources of TAC emissions. Screening levels indicate that sensitive receptors within the Planning Area would be exposed to levels of TACs and/or $PM_{2.5}$ that could cause an unacceptable cancer risk or hazard near highways and stationary sources.

TAC sources were identified within a 1,000 foot radius from the Planning Area. These sources include: stationary sources permitted by BAAQMD, roadways with more than 10,000 annual average daily traffic (AADT), and highways or freeways. Then, using the screening analysis tools – the stationary source screening analysis tool, the highway screening analysis tool, and the roadway screening analysis tool – potential risk and hazard impacts were assessed.

Stationary Sources

The Planning Area has numerous permitted stationary sources. These sources are located throughout the City, but mostly in industrial and commercial areas. The impact of these sources can only be addressed on a project-by-project basis, since impacts are generally localized. To assist lead agencies, BAAQMD has provided a database of permitted sources for each County. The database is contained in a Google Earth tool that allows a user to identify stationary sources within 1,000 feet of a receptor. The database can then be accessed through Google Earth to determine conservative screening levels of cancer risk, hazards, and $PM_{2.5}$ concentrations. This allows many of the sources to be screened out of any additional analysis. Stationary sources that show the potential for significant community risk impacts after this first level of review are further analyzed by contacting BAAQMD for additional information and applying distance

[9] The Hazard Index is the ratio of the computed receptor exposure level to the level known to cause acute or chronic adverse health impacts, as identified by BAAQMD.

adjustment factors. A refined modeling analysis would be required if there are sources that still have potentially significant impacts after this level of review. A refined analysis would include dispersion modeling of the source using emissions and source information provided by BAAQMD. If the source still has significant community risk impacts following this level of effort, then risk reduction strategies would have to be implemented by the project on a case-by-case basis.

When siting new sensitive receptors, the BAAQMD Guidelines advise that lead agencies examine existing or future proposed sources of TAC and/or $PM_{2.5}$ emissions that would adversely affect individuals within the planned project. New residences and sensitive receptors could be located near stationary sources of TACs located throughout the City, such as gasoline dispensing stations, and emergency back-up diesel generators. Without proper setbacks or mitigation measures, these sources could result in TAC levels that would be significant for new sensitive receptors.

Gasoline Stations

The Plan Bay Area DEIR[10] recommends a setback of 300 feet for large gasoline dispensing facilities (3.6 million gallons of throughput a year) and 50 feet for small facilities. This is consistent with CARB recommendations, which found that, except for the largest gasoline stations, health risks near gasoline stations should be less than 10 in one million at distances beyond 50 feet.

Dry Cleaning Facilities

Perchlorethylene (Perc) is the solvent used commonly in past dry cleaning operations. Perc is a TAC because it has the potential to cause cancer. In 2005, CARB recommended setbacks of 300 feet between dry cleaning facilities that emit Perc and sensitive land uses. Since then, CARB has enacted new rules to substantially reduce Perc emissions and phase out the use of TACs in dry cleaning by 2023. Most of these operations have phased our TAC use and are no longer considered TAC sources. Dry cleaning operations are not considered a long-term TAC source that leads to excess cancer risk in this assessment.

Emergency Back-Up Generators

Electricity generators that are powered by diesel engines are common. They are typically located at facilities where uninterrupted electricity is necessary. Common facilities include fire and police stations, hospital or medical treatment facilities, pump stations, schools, offices, and

[10] Association of Bay Area Governments, Metropolitan Transportation Commission, 2013. *Draft Plan Bay Area Environmental Impact Report*. State Clearinghouse No. 2012062029. April.

data centers. Diesel engines powering these generators are regulated by BAAQMD and CARB. CARB has established strict emissions limits and operating restrictions for engines larger than 50 horsepower. BAAQMD has developed criteria (Regulation 2 Rule 5) for approval of projects with new or modified emission sources of TACs. As a result, all new engines have very localized impacts and would not be permitted if they would cause significant cancer risks or hazards. Existing engines are only permitted to operate for 50 hours per year for maintenance or routine testing.

Specific stationary sources in the Plan Area were identified using BAAQMD's *Stationary Source Screening Analysis Tool*, as described above. The BAAQMD data provide the screening risk, hazard and $PM_{2.5}$ concentration levels associated with each source. Table 6 identifies the approximate setback distances from stationary sources that have potentially significant impacts using the screening data provided by BAAQMD and the *Risk and Hazards Emissions Screening Calculator (Beta Version)* tool. However, refined analysis of the effects from these sources through emissions and dispersion modeling would likely show lower TAC exposure.

Certain stationary sources in the BAAQMD tool are marked as "No Data." In these cases, project-specific analysis would be required by contacting BAAQMD for more information or data and possibly conducting refined modeling if screening emissions are found to exceed thresholds. Stationary sources that do not have potentially significant impacts at 50 feet (or near the source) were not included in Table 6.

TABLE 6. Approximate Screening Setback Distances for Stationary TAC Sources

Source	Distance in Feet to Cancer Risk Threshold	Distance in Feet to $PM_{2.5}$ Threshold
IKEA California, LLC, generator, Plant 15292 1700 E. Bayshore Road, East Palo Alto	525	<50
University Circle, generator, Plant 15835 1900 University Avenue, East Palo Alto	361	<50
3E Company/Regulatory Dept. c/o Home Depot, generator, Plant 17710 1781 E. Bayshore Road, East Palo Alto	262	<50
East Palo Alto Shell, Plant G9055 2194 University Avenue, East Palo Alto	131	<50
Acclarent, Inc., Plant 19870 1525 B O'Brien Drive, Menlo Park	1,000 Project-specific analysis required	1,000 Project-specific analysis required
Menlo Business Park, LLC, generator, Plant 18066 1455 Adams Drive, Menlo Park	164	<50

na = not applicable

Highway and Roadway Traffic

The BAAQMD *Highway Screening Analysis Tool* indicates significant TAC exposures along the following highways in terms of cancer risk and $PM_{2.5}$ exposure: US Highway 101, and State Routes 109 and 114 (SR 109 and SR 114). Table 7 identifies the approximate setback distances from highway sources that have potentially significant impacts at a distance of 50 feet or greater, using the data provided by BAAQMD. However, refined analysis of the effects from these sources through emissions and dispersion modeling would likely show lower TAC exposure.

In addition, BAAQMD provides a screening calculator that predicts community risk impacts that roadways pose. Using 2040 Plus Project p.m. peak hour traffic volumes provided by *Kittelson & Associates* and assuming that average daily traffic (ADT) is approximately ten times p.m. peak hour, the highest volume roadway segment in the City would be Bayshore Road at Pulgas Avenue, with an estimated ADT of 29,160. The BAAQMD *Roadway Screening Analysis Calculator* indicates that community risk from high volume surface streets such as Bayshore Road would be less than significant with ADT of 29,160 vehicles or less at a distance of 115 feet.

TABLE 7. Screening Setback Distances for Highway TAC Sources

Source	Distance in Feet to Cancer Risk Threshold	Distance in Feet to $PM_{2.5}$ Threshold
US Route 101 (south of)	500	200
US Route 101 (north of)	750	200
SR 114/Willow Road (east of)	200	<50
SR 109/University Avenue (west of)	<50	<50
SR 109/University Avenue (east of)	<50	<50

Summary

The General Plan Update would allow growth of new residential land uses that would be sensitive receptors and new non-residential land uses that are a potential for new emissions sources. Typically, these sources would be evaluated through the BAAQMD permit process or the CEQA process to identify and mitigate any significant exposures. However, some sources that would not undergo such a review, such as truck loading docks or truck parking areas, may have the potential to cause significant increases in TAC exposure. This impact would be **potentially significant**. Implementation of Mitigation Measure AQ-4 would reduce this impact. However, it is not possible to determine at this stage of the planning process that all impacts could be reduced to a less-than-significant level from larger sources. Therefore, this impact would remain **significant and unavoidable**.

Mitigation Measure AQ-4 The following measures shall be utilized in site planning and building designs to reduce TAC and $PM_{2.5}$ exposure where new receptors are located within the setback distances identified above:

- Future development under the General Plan Update that includes sensitive receptors (such as schools, hospitals, daycare centers, or retirement homes) located within the setback distances from highways, railroads, local roadways, and stationary sources shall require site-specific analysis to determine the level of TAC and $PM_{2.5}$ exposure. This analysis shall be conducted following procedures outlined by BAAQMD. If the site-specific analysis reveals significant exposures, such as cancer risk greater than 10 in one million or cumulative cancer risk greater than 100 in one million, additional measures shall be employed to reduce the risk to below the threshold. If this is not possible, the sensitive receptors shall be relocated.
- Future non-residential developments would be evaluated through the CEQA process or BAAQMD permit process to ensure that they do not cause a significant health risk in terms of excess cancer risk greater than 10 in one million, acute or chronic hazards with a Hazard Index greater than 1.0, or annual $PM_{2.5}$ exposures greater than 0.3 $\mu g/m^3$, or a significant cumulative health risk in terms of excess cancer risk greater than 100 in one million, acute or chronic hazards with a Hazard Index greater than 10.0, or annual $PM_{2.5}$ exposures greater than 0.8 $\mu g/m^3$.
- For significant cancer risk exposure, as defined by BAAQMD, indoor air filtration systems shall be installed to effectively reduce particulate levels to a less-than-significant level. Project sponsors shall submit performance specifications and design details to demonstrate that lifetime residential exposures would result in less-than-significant cancer risks (less than 10 in one million chances or 100 in one million for cumulative sources).
- Air filtration systems installed shall be rated MERV-13 or higher and a maintenance plan for the air filtration system shall be implemented.
- Trees and/or vegetation shall be planted between sensitive receptors and pollution sources, if feasible. Trees that are best suited to trapping particulate matter shall be planted, including the following: Pine (Pinus nigra var. maritime), Cypress (X Cupressocyparis leylandii), Hybrid popular (Populus deltoids X trichocarpa), and Redwoods (Sequoia sempervirens).
- Sites shall be designed to locate sensitive receptors as far as possible from any freeways, roadways, refineries, diesel generators, distribution centers, and rail lines.

- Operable windows, balconies, and building air intakes shall be located as far away from these sources as feasible. If near a distribution center, residents shall not be located immediately adjacent to a loading dock or where trucks concentrate to deliver goods.

Impact 5: Create objectionable odors affecting a substantial number of people?

Subsequent land use activities associated with implementation of the General Plan Update could allow for the development of uses that have the potential to produce odorous emissions either during the construction or operation of future development. Additionally, subsequent land use activities may allow for the construction of sensitive land uses (i.e., residential development, schools, parks, offices, etc.) near existing or future sources of odorous emissions.

Future construction activities could result in odorous emissions from diesel exhaust associated with construction equipment. However, because of the temporary nature of these emissions and the highly diffusive properties of diesel exhaust, exposure of sensitive receptors to these emissions would be limited.

Significant sources of offending odors are typically identified based on complaint histories received and compiled by BAAQMD. It is difficult to identify sources of odors without requesting information by specific facility from BAAQMD. Typical large sources of odors that result in complaints are wastewater treatment facilities, landfills including composting operations, food processing facilities, and chemical plants. Other sources, such as restaurants, paint or body shops, and coffee roasters typically result in localized sources of odors. Table 8 identifies screening buffers included in the BAAQMD CEQA Air Quality Guidelines that could apply to the Plan Area.

TABLE 8. Odor Screening Distances for the General Plan Update

Land Use/Type of Operation	Project Screening Distance
Wastewater Treatment Plant	2 miles
Wastewater Pumping Facilities	1 mile
Sanitary Landfill	2 miles
Transfer Station	1 mile
Composting Facility	1 mile
Asphalt Batch Plant	2 miles
Chemical Manufacturing	2 miles
Fiberglass Manufacturing	1 mile
Painting/Coating Operations	1 mile
Coffee Roaster	1 mile
Food Processing Facility	1 mile
Green Waste and Recycling Operations	1 mile

According to the BAAQMD CEQA Guidelines, an odor source with five or more confirmed complaints per year averaged over three years is considered to have a significant impact. To avoid significant impacts, the BAAMQD CEQA Guidelines recommend that buffer zones to avoid adverse impacts from odors should be reflected in local plan policies, land use maps, or implementing ordinances. The Plan Area includes potential odor sources throughout that could affect new sensitive receptors. Most of these major existing sources are already buffered. However, it is possible that odors may be present. Responses to odors are subjective, and vary by individual and type of use. Sensitive land uses that include outdoor uses, such as residences and possibly daycare facilities, are likely to be affected most by existing odors. The General Plan Update does not have policies or implementing measures that address potential conflicts in land uses that could result in odor complaints. As a result, the impact would be considered **potentially significant**. Implementation of Mitigation Measure AQ-5 would reduce this impact to a level of **less than significant**.

Mitigation Measure AQ-5 The following Policy and Action Measures should be added to the General Plan Update:

- New Goal AQ-5.1: *Avoid Odor Conflicts*. Coordinate land use planning to prevent new odor complaints.

- New Policy AQ-5.1A: *Identify Potential for Odor Complaints*. Use BAAQMD Odor Screening Distances or City-specific screening distances to identify odor potential. Evaluate odors from sources within these screening distances based on odor potential, wind conditions, setback distance and receptor type.
- New Policy AQ-5.1B: *Odor Sources.* Prohibit new sources of odors that have the potential to result in frequent odor complaints unless it can be shown that potential odor complaints can be mitigated.
- New Policy AQ-5.1C: *Limit Sensitive Receptors Near Odor Sources.* Prohibit sensitive receptors from locating near odor sources where frequent odor complaints would occur, unless it can be shown that potential odor complaints can be mitigated.

Impact 6: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

The BAAQMD CEQA Air Quality Guidelines contain methodology and thresholds of significance for evaluating GHG emissions from land use type projects. The BAAQMD thresholds were developed specifically for the Bay Area after considering the latest Bay Area GHG inventory and the effects of AB 32 scoping plan measures that would reduce regional emissions. BAAQMD intends to achieve GHG reductions from new land use developments to close the gap between projected regional emissions with AB 32 scoping plan measures and the AB 32 targets. The BAAQMD suggests applying a Plan-level GHG efficiency threshold of 6.6 MT per year per capita.[11] Plans with emissions above the threshold would be considered to have a cumulatively significant impact.

GHG emissions were computed for the full build-out traffic scenario, with operational emissions in 2040 using the California Emissions Estimator Model Version 2013.2.2 (CalEEMod). General Plan land use types and size, and trip generation rate were input to CalEEMod. CalEEMod predicts emissions of GHG in the form of equivalent carbon dioxide emissions or CO_2e.

Construction Period Emissions

The BAAQMD does not have an adopted Threshold of Significance for construction-related GHG emissions. BAAQMD encourages the incorporation of best management practices to reduce GHG emissions during construction where feasible and applicable, including, but not limited to: using alternative-fueled (e.g., biodiesel, electric) construction vehicles/equipment for at least 15 percent of the fleet, using local building materials of at least 10 percent, and recycling or reusing at least 50 percent of construction waste or demolition materials.

[11] BAAQMD. 2011. *Op. cit*.

Operational Period Emissions

The CalEEMod model along with the project vehicle trip generation rates were used to predict GHG emissions associated with operation of fully developed sites under the General Plan Update. The model uses mobile emission factors from CARB's EMFAC2011. CalEEMod is sensitive to the year selected, since vehicle emissions have and continue to be reduced due to more stringent exhaust controls, newer vehicle fleet, fuel efficiency standards, and low carbon fuels. Adjustments to the modeling are described below. CalEEMod output worksheets are provided in *Attachment 1*.

Year of Analysis

Emissions associated with vehicle travel depend on the year of analysis. The earlier the year, the higher the emission rates, as CalEEMod uses CARB's EMFAC2011 motor vehicle emissions model. This model assumes reduced emission rates as newer vehicles with lower emission rates replace older, more polluting vehicles through attrition of the overall vehicle fleet. The earliest year the full build-out could be possibly constructed and fully operated would be 2040, though the year 2035 was input to CalEEMod, since this is the latest available year in the model.

Land Use Descriptions

The following land uses types and sizes were input to CalEEMod: "Single Family Housing" (4,778 dwelling units), "Apartments Low Rise" (5,218 dwelling units), "Strip Mall"/commercial/retail (1,087,606 square feet), "General Office Building" (3,102,893 square feet), and "Industrial Park" (393,587 square feet).

Trip Generation Rates and Travel Distances

CalEEMod allows the user to enter specific trip generation rates. *Kittelson & Associates* provided the daily trip generation rates for the General Plan land uses. Daily trip generation rates were then entered into the model.

Electricity Generation

Default rates for energy consumption were assumed in the model. CalEEMod has a default rate of 641.3 pounds of CO_2 per megawatt of electricity produced, which is based on PG&E's 2008 emissions rate. The PG&E rate was updated to be the most recent rate reported in the California Climate Registry that was for 2013, which is 429.64 pounds of CO_2 per megawatt of electricity produced.[12] Default model assumptions for GHG emissions associated with area sources, solid waste generation and water/wastewater use were applied to the project.

Service Population Rate

The service population rate for this project is the annual GHG emissions expressed in metric tons divided by the estimated number of new residents and employees. The number of 2040 Plan Area residents is anticipated to be 37,378 and the number of 2040 Plan Area employees is anticipated at 11,650, for a total service population of 49,028 for the City.

GHG Operational Emissions

Table 9 presents the results of the CalEEMod model analysis in terms of annual metric tons of equivalent CO_2e emissions (MT of CO_2e/yr) and per capita values. The CalEEMod modeling data are provided in *Attachment 1*.

As shown in Table 9, 2040 full build-out operation of the General Plan Update would have annual service population emissions of 3.1MT of CO_2e/yr/S.P., which would not exceed the BAAQMD general plan-level threshold of 6.6 MT of CO_2e/year/S.P. This impact is, therefore, considered **less than significant**.

TABLE 9. 2040 Project GHG Emissions (MT of CO_2e)

Source Category	2040 CO_2e
Area	1,240
Energy Consumption	45,871
Mobile	96,023
Solid Waste Generation	5,757
Water Usage	3,709
Total	152,600
Per Capita Emissions[1]	3.1
BAAQMD Threshold	6.6 MT CO_2e/year/S.P.

Notes: [1]Based on a total service population of 49,028.

[12] See Climate Registry most current version of default emissions factors: http://www.theclimateregistry.org/tools-resources/reporting-protocols/general-reporting-protocol. Accessed: October 30, 2015

Attachment 1: CalEEMod Input and Output Worksheets

East Palo Alto GP Update

San Mateo County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	3,102.89	1000sqft	71.23	3,102,893.00	0
Industrial Park	393.59	1000sqft	9.04	393,587.00	0
Apartments Low Rise	5,218.00	Dwelling Unit	326.13	5,218,000.00	14923
Single Family Housing	4,778.00	Dwelling Unit	1,551.30	8,600,400.00	13665
Strip Mall	1,087.61	1000sqft	24.97	1,087,606.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 70

Climate Zone 5 **Operational Year** 2035

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 429.64 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Using most recent, verified PG&E rate

Land Use - From 2040 Plus GP Project (Buildout) spreadsheet, rev run 12/10/15

Vehicle Trips - From project weekday trip generation rates

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	10,000.00	1.00
tblConstructionPhase	PhaseEndDate	1/2/2017	1/3/2011
tblConstructionPhase	PhaseStartDate	1/1/2017	1/2/2011

tblLandUse	LandUseSquareFeet	3,102,890.00	3,102,893.00
tblLandUse	LandUseSquareFeet	393,590.00	393,587.00
tblLandUse	LandUseSquareFeet	1,087,610.00	1,087,606.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	429.64
tblProjectCharacteristics	OperationalYear	2014	2035
tblVehicleTrips	WD_TR	6.59	6.65
tblVehicleTrips	WD_TR	11.01	11.42
tblVehicleTrips	WD_TR	6.96	6.83
tblVehicleTrips	WD_TR	9.57	9.52
tblVehicleTrips	WD_TR	44.32	42.70

2.0 Emissions Summary

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	118.3376	1.4504	122.9602	0.0542		7.5434	7.5434		7.5432	7.5432	746.3197	444.5292	1,190.8489	1.6964	0.0421	1,239.5104
Energy	2.3838	20.5945	10.3111	0.1300		1.6470	1.6470		1.6470	1.6470	0.0000	45,601.4360	45,601.4360	1.9378	0.7399	45,871.4937
Mobile	43.1419	64.4807	376.1894	1.5504	116.1010	1.6127	117.7137	31.1438	1.4908	32.6346	0.0000	95,965.1497	95,965.1497	2.7503	0.0000	96,022.9063
Waste						0.0000	0.0000		0.0000	0.0000	2,568.9136	0.0000	2,568.9136	151.8184	0.0000	5,757.1009
Water						0.0000	0.0000		0.0000	0.0000	436.0171	1,993.5410	2,429.5581	44.9177	1.0853	3,709.2625
Total	**163.8633**	**86.5256**	**509.4607**	**1.7346**	**116.1010**	**10.8031**	**126.9040**	**31.1438**	**10.6809**	**41.8247**	**3,751.2503**	**144,004.6558**	**147,755.9062**	**203.1206**	**1.8672**	**152,600.2738**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	43.1419	64.4807	376.1894	1.5504	116.1010	1.6127	117.7137	31.1438	1.4908	32.6346	0.0000	95,965.1497	95,965.1497	2.7503	0.0000	96,022.9063

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	34,699.70	37,360.88	31673.26	77,345,947	77,345,947
General Office Building	35,435.04	7,353.86	3040.84	64,035,093	64,035,093
Industrial Park	2,688.22	980.04	287.32	5,509,007	5,509,007
Single Family Housing	45,486.56	48,162.24	41903.06	101,253,140	101,253,140
Strip Mall	46,440.78	45,722.96	22219.79	66,033,675	66,033,675
Total	164,750.29	139,579.97	99,124.27	314,176,863	314,176,863

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4
Industrial Park	9.50	7.30	7.30	59.00	28.00	13.00	79	19	2
Single Family Housing	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3
Strip Mall	9.50	7.30	7.30	16.60	64.40	19.00	45	40	15

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.580316	0.061477	0.172612	0.114283	0.029954	0.004183	0.017542	0.005183	0.002987	0.003460	0.006858	0.000190	0.000953

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	22,010.1817	22,010.1817	1.4857	0.3074	22,136.6670
NaturalGas Unmitigated	2.3838	20.5945	10.3111	0.1300		1.6470	1.6470		1.6470	1.6470	0.0000	23,591.2543	23,591.2543	0.4522	0.4325	23,734.8267

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Industrial Park	7.98588e+006	0.0431	0.3915	0.3288	2.3500e-003		0.0298	0.0298		0.0298	0.0298	0.0000	426.1570	426.1570	8.1700e-003	7.8100e-003	428.7505
Single Family Housing	2.43774e+008	1.3145	11.2327	4.7799	0.0717		0.9082	0.9082		0.9082	0.9082	0.0000	13,008.6855	13,008.6855	0.2493	0.2385	13,087.8542
Strip Mall	5.22051e+006	0.0282	0.2559	0.2150	1.5400e-003		0.0195	0.0195		0.0195	0.0195	0.0000	278.5862	278.5862	5.3400e-003	5.1100e-003	280.2817
Apartments Low Rise	1.22146e+008	0.6586	5.6283	2.3950	0.0359		0.4551	0.4551		0.4551	0.4551	0.0000	6,518.1630	6,518.1630	0.1249	0.1195	6,557.8315
General Office Building	6.29577e+007	0.3395	3.0862	2.5924	0.0185		0.2346	0.2346		0.2346	0.2346	0.0000	3,359.6626	3,359.6626	0.0644	0.0616	3,380.1089
Total		**2.3838**	**20.5945**	**10.3111**	**0.1300**		**1.6470**	**1.6470**		**1.6470**	**1.6470**	**0.0000**	**23,591.2543**	**23,591.2543**	**0.4522**	**0.4325**	**23,734.8267**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Low Rise	1.85571e+007	3,616.4315	0.2441	0.0505	3,637.2139
General Office Building	4.30682e+007	8,393.1834	0.5665	0.1172	8,441.4163
Industrial Park	5.46299e+006	1,064.6348	0.0719	0.0149	1,070.7529
Single Family Housing	3.32261e+007	6,475.1436	0.4371	0.0904	6,512.3542
Strip Mall	1.26271e+007	2,460.7884	0.1661	0.0344	2,474.9297
Total		**22,010.1817**	**1.4857**	**0.3074**	**22,136.6670**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Unmitigated	118.3376	1.4504	122.9602	0.0542		7.5434	7.5434		7.5432	7.5432	746.3197	444.5292	1,190.8489	1.6964	0.0421	1,239.5104

6.2 Area by SubCategory

Unmitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Architectural Coating	12.1177					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	71.8709					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	32.1338	0.5967	48.9578	0.0503		7.1317	7.1317		7.1314	7.1314	746.3197	323.2078	1,069.5275	1.5807	0.0421	1,115.7610
Landscaping	2.2152	0.8537	74.0024	3.9200e-003		0.4118	0.4118		0.4118	0.4118	0.0000	121.3213	121.3213	0.1156	0.0000	123.7494
Total	**118.3376**	**1.4504**	**122.9602**	**0.0542**		**7.5434**	**7.5434**		**7.5432**	**7.5432**	**746.3197**	**444.5292**	**1,190.8489**	**1.6964**	**0.0421**	**1,239.5104**

7.0 Water Detail

7.1 Mitigation Measures Water

Category	Total CO2	CH4	N2O	CO2e
	MT/yr			
Unmitigated	2,429.5581	44.9177	1.0853	3,709.2625

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Low Rise	339.974 / 214.331	612.5535	11.1121	0.2686	929.1816
General Office Building	551.488 / 338.009	987.0589	18.0251	0.4357	1,500.6392
Industrial Park	91.0177 / 0	124.8542	2.9723	0.0714	209.3969
Single Family Housing	311.306 / 196.258	560.9009	10.1751	0.2460	850.8298
Strip Mall	80.562 / 49.3767	144.1907	2.6331	0.0636	219.2150
Total		**2,429.5581**	**44.9177**	**1.0853**	**3,709.2625**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Unmitigated	2,568.9136	151.8184	0.0000	5,757.1009

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Low Rise	2400.28	487.2352	28.7948	0.0000	1,091.9254
General Office Building	2885.69	585.7690	34.6180	0.0000	1,312.7461
Industrial Park	488.05	99.0697	5.8549	0.0000	222.0217
Single Family Housing	5739.3	1,165.0260	68.8511	0.0000	2,610.8984
Strip Mall	1141.99	231.8137	13.6998	0.0000	519.5093
Total		**2,568.9136**	**151.8184**	**0.0000**	**5,757.1009**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX C

Biological Resources Report

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H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

East Palo Alto General Plan Update
Biological Resources
Existing Conditions Report

Project # 3328-06

Prepared for:

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Table of Contents

Photos

Figures

Tables

Section 1.0 Introduction

The purpose of this study is to describe the existing conditions of biological resources within the area under consideration for the East Palo Alto General Plan update. H. T. Harvey & Associates has conducted an extensive review of existing information regarding biological resources within the General Plan update area (hereafter planning area) and compiled relevant information into this report. This information can then be used in guiding the formulation of development scenarios for the General Plan update and in assessing impacts of these scenarios on biological resources in the General Plan update Environmental Impact Report (EIR).

Section 2.0 Environmental Setting

2.1 Location

The City of East Palo Alto is located near the southern end of the San Francisco Peninsula, adjacent to San Francisco Bay, within San Mateo County (Figure 1). It is situated between the cities of Menlo Park in San Mateo County and Palo Alto in Santa Clara County, with Highway 101 running through the southwestern portion of the City. The East Palo Alto planning area encompasses approximately 2.5 square miles, and consists of the jurisdictional city limits, which are generally defined by San Francisco Bay on the east, industrial sections and the Belle Haven area of Menlo Park to the north, the Willows section of Menlo Park to the west, and the City of Palo Alto to the west and south (Figure 2). San Francisquito Creek forms the southern boundary of the City.

The East Palo Alto planning area encompasses a variety of land uses, including commercial, industrial, and community uses. However, the City is primarily a residential community, consisting of a number of distinct neighborhoods defined by natural and manmade physical features, as well as major roads. Vacant land primarily consists of individual parcels or small groups of parcels, which are generally surrounded by development. While the City is primarily an urbanized area, it has retained a large expanse of northern coastal salt marsh habitat, a sensitive natural community, adjacent to San Francisco Bay.

2.2 Topography and Elevation

Topography in East Palo Alto is flat to gently sloping with elevations ranging from 0 to 35 feet above mean sea level (msl). Elevation is highest near the southwest corner of the City and lowest on the eastern side of the City, adjacent to San Francisco Bay.

2.3 Climate and Hydrology

The climate in East Palo Alto is typical of the Bay area. Winters are cool and wet, while summers are warm and dry. The long term (1981–2010) average annual precipitation in the City is approximately 16.50 inches, with roughly 75 percent of precipitation occurring during a four-month period from December to March (PRISM Climate Group 2013). The average high temperature is 69 degrees Fahrenheit (ºF) while the average low temperature is 50 ºF.

2.4 Soils

The City is located on an alluvial plain adjacent to the Bay, east of the Santa Cruz Mountain foothills in the Coast Ranch Geomorphic Province of Central California. The regional geology includes near-surface sediments described as Quaternary Alluvium, consisting of gravels, sands, silts, and clay. Eight soils series are found within the planning area (Table 1; Figure 3), the majority of which are different types of urban fill soils.

Table 1. Soil Types in the Planning Area

Soil Series Number	Soil Series Name
108	Botella-Urban land complex, 0 to 5 percent slopes
117	Novato clay, 0 to 1 percent slopes
118	Novato clay, 0 to 1 percent slopes ponded
121	Orthents, cut and fill, 0 to 15 percent slopes
131	Urban land
132	Urban land-Orthents, cut and fill complex, 0 to 5 percent slopes
134	Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes
139	Water

Section 3.0 Methodology

This existing conditions report was prepared based on extensive review of existing information regarding the physical and biological conditions in the planning area. Some of the major documents reviewed in the preparation of this report include the current City of East Palo Alto General Plan (City of East Palo Alto 1999); Ravenswood/4 Corners TOD Specific Plan Final EIR (City of East Palo Alto 2012); San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project San Francisco Bay to Highway 101 Final EIR (ICF International 2012); biological resources reports previously prepared by H. T. Harvey & Associates and others for various sites in the City and vicinity; aerial photos and topographic maps; and U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory Maps.

Existing habitats within the planning area, as well as potentially sensitive biological areas (i.e., areas supporting regulated and other sensitive habitats and areas providing potential habitat for special-status species) were identified and mapped primarily based on the review of existing sources of information described above. However, a reconnaissance-level field survey of the planning area was conducted by H. T. Harvey & Associates plant ecologist Chris Gurney, M.S, on 15 August 2013 and senior wildlife ecologist Ginger Bolen, Ph.D., on 18 August 2013. The purpose of this survey was to ground-truth results of the "remote sensing" evaluation in order to more accurately characterize existing site conditions.

To develop a list of species and habitats of concern that may occur in the planning area, H. T. Harvey & Associates biologists collected and reviewed information concerning threatened, endangered, or other special-status species, and habitats of concern. In addition to the previously described documents, these sources included Rarefind data (California Natural Diversity Database [CNDDB] 2013) for the *Palo Alto* and *Mountain View*, *California* U.S. Geological Survey (USGS) 7.5-minute quadrangles in which the planning area occurs; Calflora (2013); the California Native Plant Society's (CNPS's) Electronic Inventory of Rare and Endangered Plants of California (CNPS 2013); the Consortium of California Herbaria (2013); *The Jepson Manual*, Second Edition (Baldwin et al. 2012); the *San Mateo Breeding Bird Atlas* (Sequoia Audubon Society 2001); and miscellaneous information available through the USFWS, the California Department of Fish and Wildlife (CDFW), and technical publications and previous reports by H. T. Harvey & Associates and others. We also generated a list of special-status species potentially occurring in the region (i.e., the *Palo Alto* and *Mountain View*, *California* USGS 7.5-minute quadrangles) via the USFWS Sacramento office website on 12 August 2013. For plants, we consulted all CNPS lists (http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi) and applicable records to determine the probability of occurrence for all special-status plant species within the planning area. Plant species names are from The Jepson Manual, Second Edition (Baldwin et al. 2012), which also supplied information regarding the distribution and habitats of CNPS Lists of category 1A, 1B, 2, 3, and 4 vascular plants in San Mateo County. Because the most sensitive habitats in the planning area are located along the Bay, we also reviewed documents pertaining to resources potentially occurring in that area, including the South Bay Salt Pond Restoration Project Final Environmental Impact Statement/Report (EDAW et al. 2007) and the Cooley Landing Wetland Restoration Biological Assessment (H. T. Harvey & Associates 1998).

From all of these sources, we created initial lists of special-status species considered for potential occurrence within the planning area. This list was then refined by analyzing the suitable microhabitat types required by each species as well as their historic and present ranges relative to the boundaries of the planning area. Limited field surveys were conducted for this existing conditions report only to ground-truth locations of specific habitats where additional information was needed. However, based on our experience with the biological resources of the City and vicinity, coupled with the extensive information available regarding these resources, more extensive field surveys were unnecessary for the purposes of this report.

Section 4.0 Existing Land Uses, Natural Communities, and Habitats

Based on dominant plant species and land uses, the planning area was determined to contain eight general natural communities/land uses: northern coastal salt marsh, non-tidal/diked salt marsh, brackish marsh, freshwater marsh, open water, non-native annual grassland/ruderal, riparian woodland, and urban/developed (Table 1; Figure 4). These habitats are listed, along with their approximate acreages within the planning area, in Table 1 and are further described below.

Table 2. Natural Community/Land Use and Biotic Habitat Acreages with the Planning Area

Natural Community/Land Use and Biotic Habitat	Acreage	Percent of Total
Northern Coastal Salt Marsh	201.37	11.95%
Non-tidal/Diked Salt Marsh	4.95	0.29%
Brackish Marsh	0.43	0.03%
Freshwater Marsh	0.57	0.03%
Open Water	41.24	2.45%
Non-native Grassland/Ruderal	108.05	6.41%
Riparian Woodland	4.82	0.29%
Urban/Developed	1323.74	78.55%
Total	**1685.17**	**100.00**

4.1 Northern Coastal Salt Marsh

Northern coastal salt marsh occurs along the eastern margin of the planning area and represents the transitional zone between the Bay and the adjacent terrestrial habitats (Figure 4; Photo 1). Salt marsh habitats in the planning area are remnants of formerly much larger marshes that have experienced significant losses since European settlement due to development/filling of the Bay. Additionally, many salt marsh habitats that have not been developed have been significantly degraded by urban runoff and water pollution. As a result, the remaining salt marsh habitat is highly valued for its function in maintaining a healthy Bay ecosystem, and northern coastal salt marsh is considered a sensitive natural community by the CDFW. According to the CNDDB (2013), the undisturbed portions of northern coastal salt marsh within the planning area are in excellent condition. This habitat supports a variety of threatened and endangered wildlife species, and provides critical filtration of sediments and toxins from the water.

The majority of the northern coastal salt marsh within the planning area is located within the Baylands Nature Preserve, which is owned by the City of Palo Alto and managed by the USFWS as part of the Don Edwards National Wildlife Refuge complex. The Baylands Nature Preserve extends from Cooley Landing south to San Francisquito Creek. It includes two contiguous salt marshes (Laumeister and Faber) with different land use histories. Laumeister Marsh extends approximately 0.46 mile from its northern border on Bay Road at

Cooley Landing to the levee that serves to divide this marsh from Faber Marsh. Faber Marsh extends south approximately 0.45 mile to San Francisquito Creek. Although the Laumeister Marsh was never diked, the Faber Marsh appears to have been diked in the 1930s and used for pasture and hay production. The levee was breached in 1971, opening the tract to tidal action and forming the current tidal connection between the Faber Marsh and the Bay. A narrower strip of salt marsh is present in the northeastern portion of the planning area, between the upland/urban areas and a tidal marsh restoration site. This restoration site, which is located immediately outside the planning area, is a former salt pond that was breached in 2000 (ESA PWA et al. 2011). Tidal salt marsh is developing rapidly within this area.

Photo 1. Northern Coastal Salt Marsh

Northern coastal salt marsh is dominated by a small number of herbaceous, salt-tolerant species that form dense stands. Species composition within this habitat varies in response to fine-scale ecological gradients related to soil salinity and frequency of inundation. The lower tidal zone (to mean high tide) is generally dominated by cordgrass (*Spartina* spp.), while the middle zone (from mean high tide to higher tide) is dominated by pickleweed (*Salicornia* spp.), and the upper zone is dominated by saltgrass (*Distichlis spicata*). Other common species found within the planning area in the middle and upper salt marsh zones include marsh gumplant (*Grindelia stricta* var. *angustifolia*), alkali heath (*Frankenia salina*), dodder (*Cuscuta salina*), and alkali weed (*Cressa truxillensis*). While native species still dominate this habitat, several invasive species including smooth cordgrass (*Spartina alterniflora*), perennial pepperweed (*Lepidium latifolium*), and alkali Russian thistle (*Salsola soda*) are also abundant.

This habitat supports high densities of several wildlife species, including several species that are endemic to the Bay. The state and federally endangered California clapper rail (*Rallus longirostris obsoletus*) nests in cordgrass, dense stands of pickleweed, and marsh gumplant in tidal marsh habitats in the South Bay, including the Baylands Nature Preserve and the adjacent Palo Alto Baylands and Ravenswood Open Space Preserve (H. T. Harvey & Associates 1991, Olofson Environmental, Inc. 2011, CNDDB 2013). This species is found in the lower marsh zone where numerous small tidal channels are present. Alameda song sparrows (*Melospiza melodia pusillula*) and Bryant's savannah sparrows (*Passerculus sandwichensis alaudinus*) also nest in salt marshes. Alameda song sparrows prefer dense herbaceous vegetation wherever it occurs throughout the marsh, while savannah sparrows nest in shorter vegetation such as pickleweed and high transitional marshes in upland ecotones.

Shorebirds, swallows, herons, egrets, blackbirds, and other avian species roost and forage, often in large numbers, in tidal salt marsh habitats in the planning area, but most do not breed in these areas. Shorebirds are most abundant in the salt marsh habitat during the nonbreeding season. Common species include the western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedora*), long-billed (*Limnodromus scolopaceus*) and short-billed dowitcher (*Limnodromus griseus*), and black-bellied plover (*Pluvialis squatarola*).

The California vole (*Microtus californicus*) is often the most common small mammal species found in salt marshes in the South Bay, but the state and federally endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) has been recorded in pickleweed-dominated marshes throughout the region, including the Baylands Nature Preserve and the adjacent Palo Alto Baylands and Ravenswood Open Space Preserve (H. T. Harvey & Associates 1991, CNDDB 2013). The salt marsh wandering shrew (*Sorex vagrans halicoetes*) is also likely to occur in salt marsh habitat within the planning area.

4.2 Non-tidal/Diked Salt Marsh

Non-tidal/diked salt marshes occur in swale depressions and other low-lying areas along the landward side of levees in the planning area (Figure 4; Photo 2). This habitat is similar in species composition to the middle/upper tidal zones of northern coastal salt marsh, but it has been cut off from tidal influence by constructed levees. Dominant plant species include pickleweed and saltgrass, along with lesser components of alkali heath and alkali weed.

Photo 2. Non-tidal/diked Salt Marsh

The non-tidal/diked salt marshes in the planning area provide roosting and foraging habitat for shorebirds such as black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), western sandpiper, and least sandpiper, as well as ducks such as the green-winged teal (*Anas crecca*), northern pintail (*Anas acuta*), mallard (*Anas platyrhynchos*), and gadwall (*Anas strepera*). Other bird species that use this habitat include the northern harrier (*Circus cyaneus*) and Bryant's savannah sparrow, which nests in pickleweed and peripheral halophytes in the upper portions of diked salt marsh habitat.

The salt marsh harvest mouse is dependent on dense vegetative cover, usually in the form of pickleweed and other salt-dependent or salt-tolerant vegetation in both tidal and diked salt marshes. House mice (*Mus musculus*) and California voles are common in diked salt marshes, particularly in the pickleweed-dominated high marsh and the peripheral halophyte zone, where the western harvest mouse (*Reithrodontomys megalotis*) also occurs. Deer mice (*Peromyscus maniculatus*), shrews, and rats are also common in these marshes. Due to their salinity, amphibians are generally absent from this habitat. However, reptiles such as the gopher snake (*Pituophis catenifer*) forage in these marshes.

4.3 Brackish Marsh

Photo 3. Brackish Marsh

Brackish marsh occurs in only one location in the planning area, where water released from a freshwater channel mixes with what would otherwise be diked/non-tidal salt marsh habitat (Figure 4; Photo 3). This habitat supports a mosaic of plant species with a range of salinity tolerances. In areas where freshwater routinely pools for long periods, freshwater species including cattails (*Typha* spp.) and California bulrush (*Schoenoplectus californicus*) dominate. Where freshwater mixes with strongly alkaline soils, brackish species including alkali bulrush (*Bolboschoenus robustus*) and fat hen (*Atriplex prostrata*) become more abundant. Further upslope, where freshwater rarely reaches, pickleweed and saltgrass are dominant. Wildlife use of the brackish marsh in the planning area is similar to that described above for non-tidal/diked salt marsh habitat.

4.4 Freshwater Marsh

Freshwater marsh occurs in only one location in the planning area, along the western edge of a freshwater pond (Figure 4; Photo 4). This habitat is routinely inundated with freshwater and is dominated by cattails. Freshwater marshes provide habitat for numerous bird species including ducks, gulls, terns, herons, egrets, and other waterbirds, although the relatively small size of the freshwater marsh within the planning area limits its value to these species. Nevertheless, American coots (*Fulica americana*), pied-billed grebes (*Podilymbus podiceps*), and several species of ducks may breed in and around emergent vegetation in this habitat. Passerine species that breed in this freshwater marshes include the marsh wren (*Cistothorus palustris*), San Francisco common yellowthroat (*Geothlypis trichas sinuosa*), and red-winged blackbird (*Agelaius phoeniceus*). Amphibians such as the native Pacific chorus frog (*Pseudacris regilla*) and western toad (*Anaxyrus boreas*), as well as the non-native American bullfrog (*Lithobates catesbeianus*), also occur in this habitat.

Photo 4. Freshwater Marsh

4.5 Open Water

Open water habitat in the planning area includes several small freshwater ponds and channels, portions of San Francisco Bay, tidal sloughs, and San Francisquito Creek (Figure 4; Photo 5). The majority of open water habitat in the planning area is tidally influenced, including the lower reach of San Francisquito Creek. The mouth of San Francisquito Creek, located between Highway 101 and the Bay, is tidally influenced and contains Bay water even during the summer months. However, San Francisquito Creek upstream of Highway 101 to Sand Hill Road in Palo Alto is typically dry during the summer months (City of Palo Alto 2006).

A number of fish use the open water habitats within San Francisquito Creek in the planning area, including several native species such as the threespine stickleback (*Gasterosteus aculeatus*), Sacramento sucker (*Catostomus occidentalis*), prickly sculpin (*Cottus asper*), California roach (*Lavinia symmetricus*), and steelhead (*Oncorhynchus mykiss*) (Leidy et al. 2005, Anderson 1995 as cited in City of Palo Alto 2006). In addition, a number of non-native fishes have been introduced to the planning area, including the brown bullhead (*Ameiurus nebulosus*), mosquitofish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), and bluegill (*Lepomis macrochirus*) (Leidy 2007).

Photo 5. San Francisquito Creek Near Outlet to San Francisco Bay

Amphibians such as the western toad, Pacific chorus frog, and non-native bullfrog also are present in the creek channel. The native western pond turtle (*Actinemys marmorata*) is present in low numbers, as are several species of non-native turtles that have been released locally from captivity, such as the red-eared slider (*Trachemys scripta elegans*). Waterbirds, such as the mallard, green heron (*Butorides virescens*), great egret, and belted kingfisher (*Megaceryle alcyon*), forage in these waters, and bats, including the Yuma myotis (*Myotis yumanensis*) and big brown bat (*Eptesicus fuscus*), forage aerially on insects over the creek.

The open water tidal sloughs within the planning area support many of the same species found within the salt marsh habitat. Shorebirds forage in the sloughs and on mudflats along the Bay edge during low tide, and other birds, including waterfowl, egrets, and rails, use the open water habitats during both low and high tide. In addition, the sloughs provide habitat for numerous fish species, including the longfin smelt (*Spirinchus thaleichthys*), leopard shark (*Triakis semifasciata*), bat ray (*Myliobatus californica*), English sole (*Parophrys vetulus*), and starry flounder (*Platichthys stellatus*), and the vegetated edges of sloughs may provide foraging habitat and protection from predators and water currents for juvenile steelhead as they move from freshwater to the ocean.

4.6 Non-native Grassland/Ruderal

Non-native grassland/ruderal habitat is found in areas that are highly disturbed but are not currently developed (Figure 4; Photo 6). Such areas include levees and upland habitat along the shoreline, as well as undeveloped parcels scattered throughout the City. In these areas, native vegetation has been modified by grading, cultivation, or other surface disturbances. Non-native, invasive species have since re-colonized and now dominate the plant community. Dominant plant species include ripgut brome (*Bromus diandrus*), wild oats (*Avena fatua*), Italian ryegrass (*Festuca perennis*), fennel (*Foeniculum vulgare*), bristly ox tongue (*Helminthotheca echioides*), and wild radish (*Raphanus sativus*). Other common species include ice plant (*Carpobrotus edulis*), yellow star thistle (*Centaurea solstitialis*), beet (*Beta vulgaris*), and curly dock (*Rumex crispus*). Occasional woody species also occur, including coast live oak (*Quercus agrifolia*), coyote brush (*Baccharis pilularis*), and olive (*Olea europaea*). Compared to inland non-native grassland/ruderal habitat, the margins adjacent to salt marsh habitat also support a higher proportion of native, alkaline tolerant species including alkali weed, alkali heath, and salt grass.

Wildlife use of grasslands in much of the planning area is limited by human disturbance, the abundance of non-native and invasive species, and isolation of grassland habitat remnants from more extensive grasslands. As a result, some of the wildlife species associated with extensive grasslands, such as grasshopper sparrows (*Ammodramus savannarum*) and western meadowlarks (*Sturnella neglecta*), are absent from small patches of grassland within the urban matrix that occupies most of the planning area.

Rodent species present in grassland habitats include the California ground squirrel (*Spermophilus beecheyi*), California vole, valley pocket gopher (*Thomomys bottae*), and deer mouse. Diurnal raptors such as red-tailed hawks (*Buteo jamaicensis*), northern harriers, white-tailed kites (*Elanus leucurus*), and American kestrels (*Falco sparverius*) forage for these small mammals over grasslands during the day, and nocturnal raptors, such as barn owls (*Tyto alba*), forage for them at night.

Mammals such as the black-tailed jackrabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*), and non-native red fox (*Vulpes vulpes*) utilize grassland habitats in the planning area for foraging. Reptiles, including the western fence lizard (*Sceloporus occidentalis*), southern alligator lizard (*Elgaria multicarinata*), western skink (*Eumeces skiltonianus*), western terrestrial garter snake (*Thamnophis elegans*), and gopher snake, also frequent this habitat.

Photo 6. Non-native Annual Grassland/Ruderal

4.7 Riparian Woodland

Within the planning area, a narrow strip of riparian woodland occurs along the banks of San Francisquito Creek upstream of Highway 101 (Figure 4; Photo 7). This habitat is moderately disturbed and supports a mix of native riparian species, non-native invasive species, and planted ornamental species. Native species observed include coast live oak, Fremont's cottonwood (*Populus fremontii*), willows (*Salix* spp.), California buckeye (*Aesculus californica*), and mugwort (*Artemisia douglasiana*). Non-native, invasive species include blue gum (*Eucalyptus globulus*), silver wattle (*Acacia dealbata*), pampas grass (*Cortaderia jubata*), Himalayan blackberry (*Rubus armeniacus*), and English ivy (*Hedera helix*). A number of planted, ornamental species have also spread from adjacent landscaping into the riparian corridor.

Riparian habitats in California generally support exceptionally rich animal communities and contribute a disproportionately high amount to landscape-level species diversity. The presence of water and abundant invertebrate fauna provide foraging opportunities for many species, and the diverse habitat structure provides cover and nesting opportunities. Within the planning area, the disturbed nature of the riparian habitat, and the lack of water during the summer months, somewhat limits the value of this habitat for wildlife. Nonetheless, it provides important habitat for many wildlife species in the region.

Riparian habitat provides suitable foraging and breeding areas for several functional groups of birds including insectivores (e.g., warblers, flycatchers), seedeaters (e.g., finches), raptors, and cavity-nesters (e.g., swallows and woodpeckers) in addition to a variety of common amphibians, reptiles, and mammals. Among the numerous species of birds that likely use the riparian habitat within the planning area for breeding are the oak titmouse (*Baeolophus inornatus*), black phoebe (*Sayornis nigricans*), western scrub-jay (*Aphelocoma californica*), and Anna's hummingbird (*Calypte anna*). Riparian habitats are also used heavily by migrants and wintering birds, and raptors, such as red-shouldered hawks (*Buteo lineatus*) and Cooper's hawks (*Accipiter cooperii*), nest within the riparian corridor and forage in adjacent habitats.

Photo 7. Riparian Woodland Adjacent to San Francisquito Creek

Several species of reptiles and amphibians occur in riparian corridors. Leaf litter, downed tree branches, and fallen logs provide cover for the arboreal salamander (*Aneides lugubris*), western toad, and Pacific chorus frog. Several lizards may also occur here, including the western fence lizard, western skink, and southern alligator lizard. Small mammals such as the deer mouse, California vole, and eastern gray squirrel (*Sciurus carolinensis*) use the riparian habitats, and the raccoon (*Procyon lotor*), striped skunk, and non-native opossum (*Didelphis virginianus*) are also common, urban-adapted species present in riparian habitat.

4.8 Urban/Developed

Human-altered landscapes that contain large amounts of paved surfaces and/or landscaped gardens with ornamental and/or weedy species are generally considered "developed." Developed land uses in the planning area include urban and suburban residential areas, commercial and office space, industrial, and urban parks and ball fields (Figure 4). Developed habitat types differ widely in the amount and types of plant species that they support. Some areas are fully developed areas barren of vegetation, and other areas, although not "natural", are largely vegetated, ranging from residential yards to urban parks. Various ornamental plant species, as well as some natives, are found within the urban setting within landscaped features. For example, blue gum eucalyptus trees and sweet gum (*Liquidambar styraciflua*) are common, and native coast live oak is found infrequently.

Urban/developed habitats typically support a suite of relatively common wildlife species that are tolerant of periodic human disturbance. Some of the most abundant species in developed habitats, such as the European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), house sparrow (*Passer domesticus*), Virginia opossum, house mouse, eastern gray squirrel, fox squirrel (*Sciurus niger*), Norway rat (*Rattus norvegicus*), and black rat (*Rattus rattus*) are non-native species that are well adapted to the cover, nesting/denning, and foraging conditions provided by developed areas. In addition, a number of native species have adapted to these conditions. Birds such as house finches (*Haemorhous mexicanus*), California towhees (*Pipilo crissalis*), American goldfinches (*Carduelis tristis*), chestnut-backed chickadees (*Poecile rufescens*), and Cooper's hawks are common in urban and suburban areas; many are attracted to bird feeders. Larger trees may support nests of red-tailed hawks, red-shouldered hawks, or great horned owls (*Bubo virginianus*). Although non-native vegetation typically supports low native bird diversity and density (Mills et al. 1989), some native birds heavily use certain non-native plants providing particular structural or food resources. For example, hooded orioles (*Icterus cucullatus*) in the planning area nest in fan palms (*Washingtonia* spp.), and large eucalyptus trees provide nesting sites for raptors and nectar and insects for a variety of birds. California gulls (*Larus californicus*) and Brewer's blackbirds (*Euphagus cyanocephalus*) are attracted to public areas where they forage for edible scraps of refuse. Pacific chorus frogs are found in backyard ponds and pools.

Structures in the planning area provide important nesting and roosting sites for some species of birds and bats. Bats such as the Yuma myotis and Brazilian free-tailed bat may roost in the Highway 101 bridge over San Francisquito Creek (Photo 8), other structures, unoccupied buildings, and/or large trees throughout the planning area. Birds such as the black phoebe and cliff swallow (*Petrochelidon pyrrhonota*) also use structures in the planning area, including the Highway 101 bridge over San Francisquito Creek, for nesting.

Photo 8. Highway 101 Bridge Over San Francisquito Creek

Section 5.0 Movement of Native Fish and Wildlife Species and Movement Corridors

Wildlife movement within or in the vicinity of the planning area takes many forms, and is different for the various suites of species associated with these lands. Bird and bat species move readily over the landscape, foraging over and within both natural lands and landscaped areas of the City. Fish species move along the San Francisquito Creek corridor, some as residents, some as anadromous species migrating upstream for spawning and rearing and downstream to marine foraging areas. Mammals of different species move within their home ranges, but also disperse between patches of high-quality habitat. Generally, reptiles and amphibians similarly settle within home ranges, sometimes moving to central breeding areas, upland refugia, or hibernacula in a predictable manner, but also dispersing to new areas. Some species, especially among the birds and bats but also including some fish, are migratory, moving into or through the City during specific seasons. Aside from bats, there are no other mammal species in the vicinity of the planning area that are truly migratory. However, the young of many mammal species disperse from their natal home ranges, sometimes moving over relatively long distances in search of new areas in which to establish.

Movement corridors are segments of land that provide link for wildlife through the mosaic of suitable and unsuitable habitat types found within a landscape while also providing cover. On a broader level, corridors also function as paths along which wide-ranging animals can travel, populations can move in response to environmental changes and natural disasters, and genetic interchange can occur. In California, environmental corridors often consist of riparian areas along streams, rivers, or other natural features. In addition, the rivers and streams themselves may serve as migration corridors for anadromous fish.

5.1 Streams and Riparian Corridors

San Francisquito Creek is the single stream flowing through the planning area. Its headwaters are in the hilly open space and rural areas west of Interstate 280. San Francisquito Creek passes through residential and commercial areas of Menlo Park, Palo Alto, and East Palo Alto. In the planning area, it is bounded by levees as it winds through the Palo Alto Baylands east of Highway 101. The creek eventually makes its way to southern San Francisco Bay just north of the Palo Alto Baylands.

San Francisquito Creek functions as a wildlife movement corridor, connecting San Francisco Bay associated habitats with low-density residential and open habitats to the west, outside of the planning area. It supports one of the few remaining steelhead runs in the South San Francisco Bay drainage (Leidy et al. 2005, Stanford University 2013). Steelhead occur in San Francisquito Creek during the upstream migration of adults (January – April) to spawning habitat in upper San Francisquito Creek, Los Trancos Creek, West Union Creek, and Bear Creek (Leidy et al. 2005), and downstream migration of both adults and smolts (February – May, but peaking in February – April) heading toward the ocean.

The riparian habitat along the creek corridor is also useful for migrating birds, which stop to rest and forage there. In addition, the portion of San Francisquito Creek within the planning area supports a suite of medium-sized (e.g., raccoons, skunks, and opossums) and small mammals (e.g., California voles, pocket gophers, and house mice), and is a corridor of movement for mammals through the predominately developed planning area.

5.2 Pacific Flyway Stopover

The wetlands along the edge of San Francisco Bay, including those in the planning area, comprise one of the most important coastal wintering and migratory habitats for Pacific Flyway shorebirds and waterfowl, most of which do not breed in the Bay but use it during migration and in winter for feeding and resting. San Francisco Bay holds higher proportions of the total wintering and migrating shorebirds on the U.S. Pacific coast than any other wetland (Western Hemisphere Shorebird Reserve Network 2009). Hundreds of thousands of shorebirds and approximately 25 species of waterfowl making their way south from the Arctic, Alaska, and western Canada pass through the region in the fall. The Western Hemisphere Shorebird Reserve Network has designated the San Francisco Bay Estuary as a site of "Hemispheric Importance" (its highest ranking), and the North American Waterfowl Management Plan has listed it as one of 34 waterfowl habitats of major concern in North America.

Section 6.0 Regulatory Setting

Biological resources are regulated by a number of federal, state, and local laws and ordinances, as described below.

6.1 Federal Regulations

6.1.1 Clean Water Act

Areas meeting the regulatory definition of "waters of the U.S." (jurisdictional waters) are subject to the jurisdiction of the U.S. Army Corps of Engineers (USACE) under provisions of Section 404 of the 1972 Clean Water Act (Federal Water Pollution Control Act) and Section 10 of the 1899 Rivers and Harbors Act (described below). These waters may include all waters used, or potentially used, for interstate commerce, including all waters subject to the ebb and flow of the tide, all interstate waters, all other waters (intrastate lakes, rivers, streams, mudflats, sandflats, playa lakes, natural ponds, etc.), all impoundments of waters otherwise defined as "waters of the U.S.," tributaries of waters otherwise defined as "waters of the U. S.," the territorial seas, and wetlands (termed Special Aquatic Sites) adjacent to "waters of the U.S." (33 CFR, Part 328, Section 328.3). Wetlands on non-agricultural lands are identified using the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987).

Areas typically not considered to be jurisdictional waters include non-tidal drainage and irrigation ditches excavated on dry land, artificially irrigated areas, artificial lakes or ponds used for irrigation or stock watering, small artificial water bodies such as swimming pools, and water-filled depressions (33 CFR, Part 328).

Construction activities within jurisdictional waters are regulated by the USACE. The placement of fill into such waters must comply with permit requirements of the USACE. No USACE permit will be effective in the absence of state water quality certification pursuant to Section 401 of the Clean Water Act. The State Water Resources Control Board (SWRCB) is the state agency together with the Regional Water Quality Control Boards (RWQCBs) charged with implementing water quality certification in California.

Project Applicability. Any work within areas defined as waters of the U.S. (i.e., wetlands and other waters) may require a Section 404 fill discharge permit from the USACE and Section 401 Water Quality Certification from the RWQCB. All marsh habitat types (i.e. northern coastal, non-tidal/diked, brackish, and freshwater) and all open water habitats would likely be regulated as waters of the U.S. Such features include small ponds and wetlands, as well as relatively large waterways such as San Francisquito Creek and the northern coastal salt marshes adjacent to San Francisco Bay.

6.1.2 Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act (1899) 33 U.S.C. 403 regulates the construction of structures, placement of fill, and introduction of other potential obstructions to navigation in navigable waters. Under Section 10 of the Act, the building of any wharfs, piers, jetties, and other structures is prohibited without Congressional approval, and excavation or fill within navigable or tidal waters requires the approval of the Chief of Engineers.

The USACE has the authority to issue permits for the discharge of refuse into, or affecting, navigable waters under section 13 of the 1899 Act (33 U.S.C. 407; 30 Stat. 1152). The Act was modified by title IV of P.L. 92-500, October 18, 1972; the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1341-1345; 86 Stat. 877), as amended, established the National Pollutant Discharge Elimination System (NPDES) permits.

Project Applicability. Section 10 jurisdiction within the planning area extends to the mean high water mark in all areas subject to the ebb and flow of the tide. This includes San Francisco Bay, tidal sloughs and low-lying marsh habitat, and the lower reach of San Francisquito Creek (to the U.S. 101 crossing).

6.1.3 Federal Endangered Species Act

The federal Endangered Species Act (FESA) protects listed wildlife species from harm or "take" which is broadly defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Take can also include habitat modification or degradation that directly results in death or injury of a listed wildlife species. An activity can be defined as "take" even if it is unintentional or accidental. Listed plant species are provided less protection than listed wildlife species. Listed plant species are legally protected from take under the FESA only if they occur on federal lands or if the project requires a federal action, such as a Clean Water Act Section 404 fill permit from the USACE.

The USFWS has jurisdiction over federally listed threatened and endangered wildlife species under the FESA, while the National Marine Fisheries Service (NMFS) has jurisdiction over federally listed, threatened and endangered, marine and anadromous fish.

Project Applicability. Federally listed animal species that regularly occur within the planning area are the federally endangered California clapper rail and salt marsh harvest mouse and the federally threatened Central California Coast steelhead. Other listed animals that may occasionally occur within the planning area include the federally endangered California least tern (*Sterna antillarum browni*), and the federally threatened green sturgeon (*Acipenser medirostris*) and western snowy plover (*Charadrius alexandrinus nivosus*). No federally listed plant species are known or reasonably expected to occur within the planning area.

6.1.4 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act governs all fishery management activities that occur in federal waters within the United States' 200-nautical-mile limit. The Act establishes eight Regional Fishery Management Councils responsible for the preparation of fishery management plans (FMPs) to achieve the optimum yield from U.S. fisheries in their regions. These councils, with assistance from the NMFS, establish Essential Fish Habitat (EFH) in FMPs for all managed species. Federal agencies that fund, permit, or implement activities that may adversely affect EFH are required to consult with the NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to recommendations by the NMFS.

Project Applicability. The San Francisco Bay is officially listed as EFH for the Pacific Coast Salmon FMP, and in the South Bay, the Chinook salmon (*Oncorhynchus tshawytscha*) represents this FMP (Pacific Fisheries Management Council 1999). However, Chinook are not known to spawn in San Francisquito Creek, and although occasional strays may occur in this creek, they are expected to occur in the planning area irregularly at best.

A number of fish species regulated by the Coastal Pelagics and Pacific Groundfish FMPs, such as the leopard shark, English sole, starry flounder, and big skate (*Raja binoculata*), occur in the tidal habitats of the South Bay and are expected to occasionally disperse upstream into the reaches of tidal sloughs in the planning area, and possibly the lower (tidal) reaches of San Francisquito Creek. Species such as the northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), and jack mackerel (*Trachurus symmetricus*) also occur in the South Bay. Thus, the NMFS would likely consider tidal waters within the planning area to be EFH related to all three of the aforementioned FMPs.

6.1.5 Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA; 16 U.S.C., §703, Supp. I, 1989) prohibits killing, possessing, or trading of migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. The trustee agency that addresses issues related to the MBTA is the USFWS. Migratory birds protected under this law include all native birds and certain game birds (e.g., turkeys and pheasants; USFWS 2005). This act encompasses whole birds, parts of birds, and bird nests and eggs. The MBTA protects active nests from destruction and all nests of species protected by the MBTA, whether active or not, cannot be possessed. An active nest under the MBTA, as described by the Department of the Interior in its 16 April 2003 Migratory Bird Permit Memorandum, is one having eggs or young. Nest starts, prior to egg laying, are not protected from destruction.

Project Applicability. All native bird species occurring in the planning area are protected by the MBTA.

6.2 State Regulations

6.2.1 Porter-Cologne Water Quality Control Act

The RWQCB is responsible for protecting surface, ground, and coastal waters within its boundaries, pursuant to the Porter-Cologne Water Quality Control Act of the California Water Code. The RWQCB has jurisdiction under Section 401 of the Clean Water Act for activities that could result in a discharge of dredged or fill material to a water body. Federal authority is exercised whenever a proposed project requires a Clean Water Act Section 404 permit from the USACE in the form of a Section 401 Water Quality Certification. State authority is exercised when a proposed project is not subject to federal authority, in the form of a Notice of Coverage, Waiver of Waste Discharge Requirements. Many wetlands fall into RWQCB jurisdiction, including some wetlands and waters that are not subject to USACE jurisdiction. RWQCB jurisdiction of other waters, such as streams and lakes, extends to all areas below the ordinary high water mark.

The SWRCB has recently developed a preliminary draft Water Quality Control Policy that addresses numerous policy elements including development of a wetland definition and description of methodology to be used in defining wetlands as part of waters of the State (SWRCB 2013).

Under the Porter-Cologne Water Quality Control Act, the SWRCB and the nine regional boards also have the responsibility of granting Clean Water Act NPDES permits and waste discharge requirements for certain point-source and non-point discharges to waters. These regulations limit impacts on aquatic and riparian habitats from a variety of urban sources.

Project Applicability. As stated above, any projects within the planning area that impact waters of the U.S./State will require 401 Certification and/or a Waste Discharge Requirement from the RWQCB. Within the planning area, specific features such as San Francisquito Creek and wetlands that are considered waters of the U.S. are also considered waters of the State, and it is possible that some features, such as isolated wetlands, that are not considered waters of the U.S. will be regulated by the RWQCB as waters of the state.

6.2.2 California Endangered Species Act

The California Endangered Species Act (CESA; Fish and Game Code of California, Chapter 1.5, Sections 2050-2116) prohibits the take of any plant or animal listed or proposed for listing as rare (plants only), threatened, or endangered. In accordance with the CESA, the CDFW has jurisdiction over state-listed species. The CDFW regulates activities that may result in "take" of individuals listed under the Act (i.e., "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). Habitat degradation or modification is not expressly included in the definition of "take" under the Fish and Game Code. The CDFW, however, has interpreted "take" to include the "killing of a member of a species which is the proximate result of habitat modification."

Project Applicability. State-listed species regularly occurring within the planning area are the state-endangered California clapper rail and salt marsh harvest mouse. The state-endangered least tern and bald eagle (*Haliaeetus leucocephalus*) and the state threatened longfin smelt and California black rail (*Laterallus jamaicensis coturniculus*) may occasionally occur in the planning area. No state listed plant species are known or reasonably expected to occur within the planning area.

6.2.3 California Environmental Quality Act

The California Environmental Quality Act (CEQA) and the CEQA Guidelines provide guidance in evaluating impacts of projects on biological resources and determining which impacts will be significant. CEQA defines "significant effect on the environment" as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under CEQA Guidelines Section 15065, a project's effects on biotic resources are deemed significant where the project would:

- "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"

In addition to the Section 15065 criteria that trigger mandatory findings of significance, Appendix G of the CEQA Guidelines provides a checklist of other potential impacts to consider when analyzing the significance of project effects. The impacts listed in Appendix G may or may not be significant, depending on the level of the impact. For biological resources, these impacts include whether the project would:

- "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 Wildlife and or U.S. Fish and Wildlife Service"
- "have 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 U.S. Fish and Wildlife Service"
- "have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act"
- "interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites"
- "conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance"
- "conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan"

Section 15380(b) of the CEQA Guidelines provides that a species not listed on the federal or state lists of protected species may be considered rare if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definitions in the FESA and the CESA and the section of the California Fish and Game Code dealing with rare or endangered plants or animals. This section was included in the guidelines primarily to deal with situations in which a public agency is reviewing a project that may have a significant effect on a species that has not yet been listed by either the USFWS or CDFW or species that are locally or regionally rare.

The CDFW has produced three lists (amphibians and reptiles, birds, and mammals) of "species of special concern" that serve as "watch lists". Species on these lists are of limited distribution or the extent of their habitats has been reduced substantially, such that threat to their populations may be imminent. Thus, their populations should be monitored. They may receive special attention during environmental review as potential rare species, but do not have specific statutory protection. All potentially rare or sensitive species, or habitats capable of supporting rare species, are considered for environmental review per the CEQA §15380(b).

The CNPS, a non-governmental conservation organization, has developed lists of plant species of concern in California. Vascular plants included on these lists are defined as follows:

- List 1A Plants considered extinct.
- List 1B Plants rare, threatened, or endangered in California and elsewhere.
- List 2 Plants rare, threatened, or endangered in California but more common elsewhere.
- List 3 Plants about which more information is needed - review list.
- List 4 Plants of limited distribution-watch list.

These CNPS listings are further described by the following threat code extensions:

- .1 — seriously endangered in California;
- .2 — fairly endangered in California;
- .3 — not very endangered in California.

Although the CNPS is not a regulatory agency and plants on these lists have no formal regulatory protection, plants appearing on List 1B or List 2 are, in general, considered to meet the CEQA's Section 15380 criteria, and adverse effects to these species may be considered significant. Impacts on plants that are listed by the CNPS on List 3 or 4 are also considered during CEQA review, although because these species are typically not as rare as those on List 1B or List 2, impacts on them are less frequently considered significant.

Project Applicability. All impacts on biological resources will be considered during CEQA review of the East Palo Alto General Plan update in the context of this EIR.

6.2.4 California Fish and Game Code

The California Fish and Game Code includes regulations governing the use of, or impacts on, many of the state's fish, wildlife, and sensitive habitats. The CDFW exerts jurisdiction over the bed and banks of rivers, lakes, and streams according to provisions of §§1601–1603 of the Fish and Game Code. The Fish and Game Code requires a Streambed Alteration Agreement for the fill or removal of material within the bed and banks of a watercourse or water body and for the removal of riparian vegetation.

Certain sections of the Fish and Game Code describe regulations pertaining to certain wildlife species. For example, Fish and Game Code §§3503, 2513, and 3800 (and other sections and subsections) protect native birds, including their nests and eggs, from all forms of take. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "take" by the CDFW. Raptors (i.e., eagles, falcons, hawks, and owls) and their nests are specifically protected in California under Fish and Game Code §3503.5. Section 3503.5 states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Non-game mammals are protected by Fish and Game Code §4150, and other sections of the Code protect other taxa.

Project Applicability. Any work within channels with a clear bed and banks, including San Francisquito Creek within the planning area, will require a Streambed Alteration Agreement from the CDFW per §1602 of the Fish and Game Code. All native bird species that occur in the planning area are protected by the state Fish and Game Code. Projects may be required to take measures to avoid impacts to nesting birds per Fish and Game Code §§3503, 3513, and 3800. Native mammals and other species within the planning area are also protected by the Fish and Game Code, and measures may be required to avoid and minimize impacts to these species during construction activities.

6.3 Local Regulations

6.3.1 City of East Palo Alto General Plan Policies

The existing City of East Palo Alto General Plan (1999) was adopted as a statement of policy for the physical development of the City of East Palo Alto. In relation to biological resources, the current General Plan has a Conservation and Open Space Element that focuses on the protection and enhancement of open space and natural resources to ensure a high quality living environment in future years. The General Plan (1999) provides the following goal and policies pertaining to natural resources:

Goal: Preserve and enhance important natural resources and features.

Policies:

- Conserve, protect, and maintain important natural plant and animal communities, such as the baylands, Cooley Landing, San Francisquito Creek, the shoreline, and significant tree stands.

- Conserve and protect important watershed areas and soils through appropriate site planning and grading· techniques, revegetation and soil management practices, and other resource management techniques.
- Preserve existing and increase the number of trees within the community.
- Maximize enjoyment and promotion of natural resource areas, such as the baylands, Cooley Landing, San Francisquito Creek, and the shoreline.

6.3.2 City of East Palo Alto Tree Protection Ordinance

The City of East Palo Alto Tree Protection Ordinance (Chapter 22, Article 4 of the East Palo Alto Zoning Ordinance) serves to protect any tree (1) having a main stem or trunk that measures 40 inches or greater in circumference at a height of 24 inches above natural grade, (2) within a public street or public right of way, regardless of size, (3) that existed at the time of an approval granted under the City's Subdivision or Zoning Ordinance and required to be preserved as part of such approval, (4) required to be planted as a condition of any development approval granted by the City, or (5) required to be planted as a replacement for an unlawfully removed tree as provided in Subsection 6420.10(a) of Article 4.

Except as otherwise provided in Subsection 6420.4, it is unlawful for any purpose to destroy or remove or cause to be destroyed or removed, any protected tree upon any private or public property in the City without first having obtained a permit to do so issued pursuant to Article 4. Further, no structure or pavement shall be constructed or installed within 8.0 feet from any tree, unless otherwise permitted by the approving authority.

Project Applicability. Any projects within the planning area that have the potential to impact trees of ordinance size must obtain a tree removal permit from the City of East Palo Alto.

Section 7.0 Special-Status Plant and Animal Species

CEQA requires assessment of the effects of a project on species that are "threatened, rare, or endangered"; such species are typically described as "special-status species". For planning purposes during the update of the East Palo Alto General Plan and for assessment of impacts of the General Plan update, special-status species have been defined as described below. Impacts on these species are regulated by some of the federal, state, and local laws and ordinances described under "Regulatory Setting" above.

7.1 Special-Status Plants

For purposes of this report, "special-status" plants are considered plant species that are:

- Listed under the FESA as threatened, endangered, proposed threatened, proposed endangered, or a candidate species.
- Listed under the CESA as threatened, endangered, rare, or a candidate species.
- Listed by the CNPS as rare or endangered on List 1A, 1B, or 2.
- Listed by the CNPS on List 3 or 4.

Eighty-four special-status plant species were identified as potentially occurring within the planning area. This species list was compiled based on CNDDB (2013) records of special-status species occurring in the *Palo Alto*, *California* USGS 7.5-minute topographic quadrangle and the eight surrounding quadrangles (*San Mateo*, *Redwood Point*, *Newark*, *Woodside*, *Mountain View*, *La Honda*, *Mindego Hill*, and *Cupertino*). In addition, we also used the CNPS Rare Plant Inventory (CNPS 2013) to identify all Rank 3 and Rank 4 species occurring in San Mateo County, because the CDDDB does not track these species. Following an analysis of the microhabitat conditions and occurrence records associated with all of the species considered, 83 of the 84 species originally considered for occurrence were rejected from further consideration. The majority of the species were rejected based on one or more of the following reasons: (1) the species has a very limited range of endemism and has never been observed in the vicinity of the planning area, (2) common plants which are nearly always associated with the special-status species, and which indicate the presence of suitable, intact habitat, are absent from the planning area, or (3) specific, edaphic soil characteristics, such as serpentine soils, are absent from the planning area. Only Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*) was carried forward for further analysis. An expanded description of this species is provided below.

Congdon's Tarplant (*Centromadia parryi* ssp. *congdonii*). Federal Listing Status: None; State Listing Status: None; CNPS List: 1B.1. Congdon's tarplant is an annual herb in the composite family (Asteraceae) that has a variable blooming period extending from June through November. It occurs in valley and foothill grasslands, particularly those with alkaline substrates, and in slumps or disturbed areas where water collects in lower elevation wetlands below approximately 760 feet. This subspecies tolerates disturbance and sometimes occurs in wet depressions of ruderal, non-native grassland habitat.

Congdon's tarplant occurs in Alameda, Contra Costa, San Mateo, Monterey, San Luis Obispo, and Santa Clara counties, but it is presumed extirpated from its historical range in Solano and Santa Cruz counties (CNPS 2013). In 2001, 17 individuals of Congdon's tarplant were observed growing in flat, ruderal grassland adjacent to salt marsh habitat within the planning area, near its northern boundary (CNDDB 2013). During the reconnaissance field visit on 15 August, a homeless camp was observed in the immediate vicinity of the record location, in addition to several dense stands of iceplant (*Carpobrotus edulis*). However, Congdon's tarplant is relatively disturbance tolerant and likely still persists in the vicinity.

7.2 Special-Status Animals

The legal status and potential for occurrence of special-status wildlife species known to occur or potentially occurring in the general vicinity of the planning area are given in Table 3. Expanded descriptions are included in Appendix C for those species known to occur within the planning area, for which potentially suitable habitat occurs within or in the general vicinity of the planning area, for which the site is accessible to animals from known populations, and for which resource agencies have expressed particular concern such that more expanded discussion is required.

Several special-status wildlife species that historically have occurred in the planning area, or that have been recorded in San Mateo County but not in the planning area itself, are not expected to be present in the planning area currently, at least not as special-status species. They include the following:

- The Bay checkerspot butterfly (*Euphydryas editha bayensis*) formerly ranged around San Francisco Bay from Twin Peaks and San Bruno Mountain on the San Francisco Peninsula east to the Franklin Canyon and Morgan Territory areas of Contra Costa County and south to Santa Clara County (Murphy and Ehrlich 1980, USFWS 1998). However, the species has been extirpated from most of its former range due to development on serpentine habitats and local extinctions resulting from severe droughts in portions of the 1970s and 1980s (USFWS 1998). Through much of the 1990s, Bay checkerspot butterflies still occurred at two locations (Jasper Ridge Biological Preserve and Edgewood Park) in San Mateo County. However, the species was last recorded at Jasper Ridge in 1997 and (prior to reintroduction attempts) at Edgewood Park in 2002 (Weiss 2002).
- The Central California Coast coho salmon (*Oncorhynchus kisutch*) was historically collected from San Mateo Creek in San Mateo County (Leidy 2007) and the species may have been present in the San Francisquito watershed (Leidy et al. 2005). However, the species has been extirpated from these watersheds and the San Francisco Bay (Leidy 2007).
- The marbled murrelet (*Brachyramphus marmoratus*) nests along the coast in southwestern San Mateo County (USFWS 1997; Sequoia Audubon Society 2001); however, the species' range is limited to old-growth coastal conifer forests (Carter and Erickson 1992 as cited in USFWS 1997) and does not occur on the Bay side of the county. Thus, the species does not occur in the planning area.
- The willow flycatcher (*Empidonax traillii*) formerly nested commonly in riparian habitats on the Santa Clara Valley floor, but local populations were extirpated by the late 1960s. This species still occurs as an uncommon migrant in the region, moving between wintering areas in Mexico and breeding areas

to the north (Unitt 1987, Hunter et al. 2005). However, migrant willow flycatchers occurring in the planning area are likely from breeding populations outside the state, and, thus, would not be individuals from the state- listed California population or the federally listed subspecies *extimus* that resides in riparian habitat of southern California (Unitt 1987).

Fourteen other bird species that are California species of special concern occur in the planning area as nonbreeding transients, foragers, or migrants, but they do not breed in or very close to the planning area and suitable nesting habitat is absent in the planning area. These include the bank swallow (*Riparia riparia*), common loon (*Gavia immer*), redhead (*Aythya americana*), Barrow's goldeneye (*Bucephala islandica*), American white pelican (*Pelecanus erythrorhynchos*), black skimmer (*Rynchops niger*), black tern (*Chlidonias niger*), short-eared owl (*Asio flammeus*), Vaux's swift (*Chaetura vauxi*), olive-sided flycatcher (*Contopus cooperi*), purple martin (*Progne subis*), yellow warbler (*Setophaga petechia*), tricolored blackbird (*Agelaius tricolor*), and grasshopper sparrow (*Ammodramus savannarum*). Because they are only considered species of special concern when nesting (Shuford and Gardali 2008), they are not special-status species when they occur as nonbreeding visitors to the planning area.

Table 3. Special-status Animal Species, Their Status, and Potential Occurrence in the Planning Area

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
Federal or State Endangered, Threatened, or Candidate Species			
Green sturgeon (*Acipenser medirostris*)	FT, CSSC	Spawns in large river systems such as the Sacramento River; forages in nearshore oceanic waters, bays, and estuaries.	**Absent as Breeder.** Known to occur in the Bay, though it apparently occurs only as a rare, nonbreeding visitor to the South Bay. May occur in the tidal reaches of sloughs in the planning area, albeit infrequently and in low numbers, if at all. Not expected to spawn in the planning area due to the relatively shallow depth of San Francisquito Creek and its lack of deep freshwater pools. All tidally influenced areas of Bay, up to the elevation of mean higher high water, including San Francisquito Creek upstream to 37°27′10″ North 122°7′40″ West, have been designated as critical habitat for this species (NMFS 2009).
Central California Coast steelhead (*Oncorhynchus mykiss*)	FT	Cool streams with suitable spawning habitat and conditions allowing migration between spawning and marine habitats.	**Present.** San Francisquito Creek contains one of the few remaining steelhead runs in the South Bay (Leidy et al. 2005, Stanford University 2013), supporting an anadromous run of steelhead up to Searsville Dam. Designated critical habitat for Central California Coast steelhead includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays (NMFS 2000, 2005). Thus, San Francisquito Creek and the tidally influenced portions of the planning area are included within designated critical habitat.
Longfin smelt (*Spirinchus thaleichthys*)	ST	Spawns in fresh water in the upper end of the San Francisco Bay; occurs year-round in the South Bay.	**Absent as Breeder.** In the South Bay, individuals have been collected in the Alviso area and in Alviso Slough (EDAW Inc. 2007). Fish sampling in Coyote Slough and the Island Ponds has detected the species in January and March, suggesting that the species may be absent from the South Bay during the summer (Hobbs et al. 2012). In the planning area, it may be present in the tidal reaches of sloughs and the open waters of the Bay. Spawning in the Bay is thought to occur mainly below Medford Island in the San Joaquin River and below Rio Vista on the Sacramento River, while the lower end of spawning habitat seems to be upper Suisun Bay around Pittsburg and Montezuma Slough, in Suisun Marsh (Larson et al. 1983 as cited in Moyle 2002, Wang 1986). The species is not expected to spawn in San Francisquito Creek.

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
California tiger salamander (*Ambystoma californiense*)	FT, SE	Vernal or temporary pools in annual grasslands or open woodlands.	**Absent.** Suitable breeding habitat is not present in, or immediately adjacent to, the planning area. Nearest known extant population is approximately 3 miles to the southwest at Lagunita in Palo Alto (CNDDB 2013).
California red-legged frog (*Rana draytonii*)	FT, CSSC	Streams, freshwater pools, and ponds with emergent or overhanging vegetation.	**Absent.** Due to their salinity, the majority of aquatic features within the planning area do not provide suitable habitat for the California red-legged frog. San Francisquito Creek within the planning area provides only marginally suitable habitat for this species; the tidal influence near the Bay, the presence of introduced aquatic predators, and the shortage of dense shrubby or emergent riparian vegetation closely associated with deep, still or slow-moving water limit habitat quality for this species. Although there are records in San Francisquito Creek over 4 miles upstream of the planning area (Stanford University 2013; CNDDB 2013), The species has not been documented within the planning area, and it has likely been extirpated entirely from lowland urban areas such as the planning area and its vicinity.
San Francisco garter snake (*Thamnophis sirtalis tetrataenia*)	FE, SE	Prefer densely vegetated freshwater habitats. May use upland burrows for aestivation.	**Absent.** Garter snakes in the planning area fall within the intergrade zone between the San Francisco garter snake and the red-sided garter snake (Barry 1994; Stanford University 2013). The intergrade populations do not belong exclusively to either subspecies; thus, true San Francisco garter snakes do not occur in the planning area.
Western snowy plover (*Charadrius alexandrinus nivosus*)	FT, CSSC	Sandy beaches on marine and estuarine shores and salt pannes in San Francisco Bay saline managed ponds.	**Absent as Breeder.** Suitable nesting habitat is not present in the planning area due to the absence of islands and undisturbed levees within the salt marsh habitat. However, the species has been documented nesting in the nearby Ravenswood Complex of the Don Edwards San Francisco Bay Wildlife Refuge (Robinson-Nilsen et al. 2010), and individuals may occasionally forage on the mudflats in the planning area (although mudflat use by this species in the South Bay is infrequent).
California least tern (*Sterna antillarum browni*)	FE, SE, SP	Nests along the coast on bare or sparsely vegetated, flat substrates. In San Francisco Bay, nests primarily on an old airport runway. Forages for fish in open waters.	**Absent as Breeder.** Does not nest in the planning area. However, the South Bay is an important post-breeding staging area for least terns to gather before migration. Least terns forage primarily in managed ponds and over the open Bay, and small numbers of foraging least terns may occur as occasional foragers over open water habitat at the edge of the Bay in the planning area.

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
California clapper rail (*Rallus longirostris obsoletus*)	FE, SE, SP	Salt marsh habitat dominated by pickleweed and cordgrass.	**Present.** Suitable breeding and foraging habitat is present in the planning area and numerous detections of this species have been recorded in salt marsh habitat both within and immediately adjacent to the planning area (Olofson Environmental, Inc. 2011, PRBO Conservation Science 2011, CNDDB 2013).
California black rail (*Laterallus jamaicensis coturniculus*)	ST, SP	Breeds in fresh, brackish, and tidal salt marsh.	**Absent as Breeder.** Occurs in the South Bay primarily as a scarce winter visitor. However, the species has recently been recorded during the breeding season in Triangle Marsh along Coyote Slough over 7 miles east of the planning area (Laurie Hall pers. com.), and along lower and mid-Alviso Slough (http://groups.yahoo.com/group/south-bay-birds), indicating that this species may nest in some areas in the South Bay. Suitable habitat for nonbreeding California black rails in the planning area occurs in tidal marshes in the Baylands Nature Preserve, and the species has been recorded in the Ravenswood Open Space Preserve just north of the planning area and on the Palo Alto Baylands to the south (eBird 2013). Thus, small numbers of California black rails may winter in the planning area.
Bald eagle (*Haliaeetus leucocephalus*)	SE, SP	Occurs mainly along seacoasts, rivers, and lakes; nests in tall trees or in cliffs, occasionally on electrical towers. Feeds mostly on fish.	**Absent as Breeder.** Has been recorded nesting in the region only at inland reservoirs. This species is very rare along the Bay edge, but it has been observed at the Palo Alto Baylands just south of the planning area (eBird 2013). Thus, the species may be present in the planning area as an occasional forager in aquatic habitats adjacent to the Bay.
Salt marsh harvest mouse (*Reithrodontomys raviventris*)	FE, SE, SP	Salt marsh habitat dominated by common pickleweed.	**Present.** Suitable habitat is present in the planning area and numerous detections of this species have been recorded in salt marsh habitat both within and immediately adjacent to the planning area (H. T. Harvey & Associates 1991, H. T. Harvey & Associates 2009, CNDDB 2013).
California Species of Special Concern			
Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*)	CSSC	Cool rivers and large streams that reach the ocean and that have shallow, partly shaded pools, riffles, and runs.	**Absent as Breeder.** Chinook salmon have not been documented in San Francisquito Creek. It is possible that occasional strays from Central Valley streams may occur in San Francisquito Creek as they do in other South Bay creeks, but they are expected to occur in the planning area irregularly at best and most likely would occur only in the open waters of the Bay.

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
Foothill yellow-legged frog (*Rana boylii*)	CSSC	Partially shaded shallow streams and riffles with a rocky substrate. Occurs in a variety of habitats in coast ranges.	**Absent.** Suitable habitat is not present in the planning area.
Western pond turtle (*Actinemys marmorata*)	CSSC	Permanent or nearly permanent water in a variety of habitats.	**May be Present.** San Francisquito Creek and freshwater marshes within the planning area provide suitable habitat for the western pond turtle, and the species has been recorded in San Francisquito Creek approximately 1 mile upstream of the planning area (CNDDB 2013).
Northern harrier (*Circus cyaneus*)	CSSC (nesting)	Nests in marshes and moist fields, forages over open areas.	**Present.** Within the planning area, one or two pairs nest and forage in the salt marshes near the Bay. Nonbreeders may occasionally forage in grassland habitats in the planning area, but are not expected to forage in more densely developed/urbanized areas.
Burrowing owl (*Athene cunicularia*)	CSSC	Open grasslands and ruderal habitats with suitable burrows, usually those made by California ground squirrels.	**Absent as Breeder.** Burrowing owls are not expected to nest in the planning area due to the absence of high quality habitat and the lack of recent breeding records in the vicinity. However, small numbers of the species may occasionally occur in grasslands and ruderal habitats in the planning area during dispersal from breeding sites to the north and south (e.g., at Bayfront Park in Menlo Park or Shoreline Park in Mountain View) or as migrants.
Loggerhead shrike (*Lanius ludovicianus*)	CSSC (nesting)	Nests in tall shrubs and dense trees; forages in grasslands, marshes, and ruderal habitats.	**May be Present.** Grassland, ruderal, and marsh communities within the planning area provide suitable nesting and foraging habitat for this species, and it is possible that a few pairs are present along the eastern edge of the planning area.
San Francisco common yellowthroat (*Geothlypis trichas sinuosa*)	CSSC	Nests in herbaceous vegetation, usually in wetlands or moist floodplains.	**Present.** The taller salt, brackish, and freshwater marsh habitat within the planning area provides suitable breeding and foraging habitat for this species.
Alameda song sparrow (*Melospiza melodia pusillula*)	CSSC	Nests in salt marsh, primarily in marsh gumplant and cordgrass along channels.	**Present.** The salt marsh habitat within the planning area provides suitable breeding and foraging habitat for this species and it has been observed in this habitat north of San Francisquito Creek within the planning area (eBird 2013).

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*)	CSSC	Nests in pickleweed dominant salt marsh and adjacent ruderal habitat.	**May be Present.** The high marsh habitat within the planning area provides suitable breeding and foraging habitat for this species.
San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*)	CSSC	Nests in a variety of habitats including riparian areas, oak woodlands, and scrub.	**May be Present.** Suitable habitat within the planning area is limited to the riparian woodlands adjacent to San Francisquito Creek upstream of the Highway 101 overcrossing.
Salt marsh wandering shrew (*Sorex vagrans halicoetes*)	CSSC	Medium-high marsh 6-8 feet above sea level with abundant driftwood and common pickleweed.	**May be Present.** The salt marsh habitat within the planning area provides suitable habitat for this species.
Pallid bat (*Antrozous pallidus*)	CSSC	Forages over many habitats; roosts in caves, rock outcrops, buildings, and hollow trees.	**Absent.** Suitable habitat is not present within the planning area and there are no recent documented occurrences in the planning area.
Townsend's big-eared bat (*Corynorhinus townsendii*)	CSSC	Roosts in caves and mine tunnels, and occasionally in deep crevices in trees such as redwoods or in abandoned buildings, in a variety of habitats.	**Absent.** Suitable habitat is not present within the planning area and there are no recent documented occurrences in the planning area.
Western red bat (*Lasiurus blossevillii*)	CSSC	Roosts in foliage in forest or woodlands, especially in or near riparian habitat.	**Absent as Breeder.** Occurs as a migrant and winter resident, but does not breed in the planning area. Small numbers may roost in foliage in trees virtually anywhere in the planning area, but expected to roost primarily in riparian areas.
State Fully Protected Species			
California brown pelican (*Pelecanus occidentalis californicus*)	FD, SD, SP (nesting colony and communal roosts)	Undisturbed islands near estuarine, marine, subtidal, and marine pelagic waters.	**Absent as Breeder.** Brown pelicans occur as nonbreeding visitors along the edge of the open Bay. However, they are expected to occur only in low numbers due to the shallow nature of the Bay waters within the planning area.

Name	*Status	Habitat	Potential for Occurrence in the Planning Area
White-tailed kite (*Elanus leucurus*)	SP	Nests in tall shrubs and trees, forages in grasslands, marshes, and ruderal habitats.	**May be Present.** Marshes and grasslands within the planning area provide suitable breeding and foraging habitat, and it is possible that a few pairs are present along the eastern edge of the planning area.
American peregrine falcon (*Falco peregrinus anatum*)	SP	Forages in many habitats; nests on cliffs and tall bridges and buildings.	**Absent as Breeder.** Electrical transmission towers over marsh habitat in the planning area provide suitable nesting habitat, as peregrine falcons have nested in other species' old nests on such towers in the Mountain View area to the southeast. However, there are no records of the species nesting in the planning area. Peregrine falcons occur as occasional foragers around the tidal marsh habitats and adjacent grasslands in the planning area.
Golden eagle (*Aquila chrysaetos*)	SP	Breeds on cliffs or in large trees (rarely on electrical towers), forages in open areas.	**Absent as Breeder.** Suitable nesting habitat is not present in the planning area. On rare occasions, this species may forage in open habitats (e.g., grasslands and marshes) within and adjacent to the planning area.

*Status Codes:

Federal and State Codes: E = Endangered; T = Threatened; C = Candidate; SC = Species of Concern (Federal); Species of Special Concern (State); FD = Federally Delisted; SD = State Delisted; SP = California Fully Protected species

Section 8.0 Invasive Species

For over 200 years, people have brought non-native plants and animals into the planning area, either accidentally (e.g., as stowaways in cargo shipments) or intentionally (e.g., imported for food, ornament, sport, or as pets), and many of these species have been introduced into the wild. Introduced species that cause harm and, once established, spread quickly from their point of introduction are often called "invasive" species. Invasive species can threaten the diversity and abundance of native species through predation, competition for resources, transmission of disease, parasitism, and physical or chemical alteration of the habitat. Their effects on natural communities also may lead to direct effects on human activities as a result of clogging waterways and water delivery systems, weakening flood protection structures, damaging crops, and diminishing sport fish populations (California Department of Fish and Game [CDFG] 2008a).

As described previously, invasive plant species are common in the planning area. Twenty-one species that have received either "moderate" of "high" impact ratings by the California Invasive Plant Council (CAL-IPC 2013) were observed during the reconnaissance-level field survey on 15 August 2013 (Table 4). Of these, perennial pepperweed and smooth cordgrass represent the greatest threats to ecosystems within the planning area. Both of these species are rated as having "high" ecological impact (CAL-IPC 2013) and can invade sensitive salt marsh habitat. Perennial pepperweed is an aggressive invader that alters soil salinity, forms dense monospecific stands, and threatens the habitat of several special-status wildlife species (CAL-IPC 2013). Smooth cordgrass spreads more rapidly, grows more densely, and tolerates higher water levels than native California cordgrass (*Spartina foliosa*). The hybridization of this species with native California cordgrass also threatens the survival of pure strains of California cordgrass (CAL-IPC 2013). Several other species including iceplant and alkali Russian thistle are also common in and near salt marsh habitats in the planning area and could results in habitat degradation.

Table 4. Invasive Plant Species Observed Within the Planning Area with a "Moderate" or "High" Impact Rating According to CAL-IPC (2013)

Scientific Name	Common Name	CAL-IPC Impact Rating
Carpobrotus edulis	iceplant	High
Centaurea solstitialis	yellow star thistle	High
Cortaderia jubata	purple pampas grass	High
Foeniculum vulgare	sweet fennel	High
Hedera helix	English ivy	High
Lepidium latifolium	perennial pepperweed	High
Rubus armeniacus	Himalayan blackberry	High

Scientific Name	Common Name	CAL-IPC Impact Rating
Spartina alterniflora/ S. alterniflora x foliosa	smooth cordgrass and hybrids	High
Avena fatua	wild oats	Moderate
Brassica nigra	black mustard	Moderate
Bromus diandrus	ripgut brome	Moderate
Carduus pycnocephalus	Italian thistle	Moderate
Cirsium vulgare	bull thistle	Moderate
Conium maculatum	poison hemlock	Moderate
Cynodon dactylon	Bermuda grass	Moderate
Dittrichia graveolens	stinkwort	Moderate
Eucalyptus globulus	blue gum	Moderate
Hirschfeldia incana	short podded mustard	Moderate
Hordeum marinum	seaside barley	Moderate
Hordeum murinum	foxtail barley	Moderate
Phalaris aquatica	Harding grass	Moderate
Salsola soda	Alkali Russian thistle	Moderate

Introduced animal species are also common in the planning area. According to Cohen and Carlton (2003), the San Francisco Estuary is the most invaded aquatic ecosystem in North America. Previous lists and/or descriptions of introduced aquatic species include works on fish fauna by Moyle (1976) and McGinnis (1984), freshwater mollusks by Hanna (1966) and Taylor (1981), marine mollusks by Nichols et al. (1986), and introduced marine and estuarine invertebrates by Carlton (Carlton 1975; Carlton 1979a; Carlton 1979b; Carlton et al. 1990). Collectively, these non-native species have significant impacts on the San Francisco Bay estuary through aggressive predation, highly efficient filter feeding, and competition, which, when magnified by the great abundance of some of these species, has the potential to change (or already has changed) the trophic structure and dynamics of the Bay ecosystem (Josselyn et al. 2004).

Cohen and Carlton (2003) note that at least 212 species, 69 percent of which are invertebrates, have been introduced to the Bay and Delta since 1850. The most important include a number of clams, many of which were introduced into the Bay via releases of ballast water (Cohen and Carlton 1995), such as the introduced Asian species of *Venerupis* and *Musculista*, and the Atlantic clam *Gemma*. With the exception of the Baltic clam, the numerically dominant mollusks of the South Bay are all non-native species (Nichols and Pamatmat 1988). Collectively, these introduced clam species are capable of filtering the entire volume of the South Bay daily, in addition to having dramatic impacts on the Bay's phytoplankton populations. Cohen and Carlton (2003) suggest that the phytoplankton populations of the northern reaches of the San Francisco Bay may be "continuously and permanently controlled by introduced clams".

A few of the more common introduced/invasive wildlife and fish species present in, or with a high potential to be introduced to, the planning area are discussed in more detail below.

The Asian clam *Potamocorbula amurensis*, the most abundant clam in the San Francisco Bay, was introduced via ballast water around 1986 (Cohen 1998). Since then, this filter feeder has impacted phytoplankton populations in the North Bay (Alpine and Cloern 1992), preventing summer phytoplankton blooms since its introduction and altering the trophic structure of the North Bay. Although similar large-scale impacts on the South Bay have not yet been detected, the species is present in the South Bay. This clam was found by a CDFW study to be the most important prey of scoters in Suisun Bay (Harvey et al. 1982).

The gem clam (*Gemma gemma*) occurs throughout the South Bay, in both deep subtidal and high intertidal habitats. It occurs in lower-salinity salt ponds as well. This clam is eaten by a variety of shorebirds (Recher 1966) and waterfowl (Painter 1966), and thus benefits some native wildlife species. The Atlantic ribbed marsh mussel (*Arcuatula demissa*) was introduced in the late 1800s, and is now common throughout much of the Bay. Although it is apparently "a major food source" for the clapper rail, rails have been known to drown after getting their beaks or toes caught in the open valves of the mussel (Takekawa 1993).

The Chinese mitten crab (*Eriocheir sinensis*) was first discovered in the South Bay in 1992 and quickly spread throughout the estuary. They have been observed in the San Francisquito Creek system since at least 1996 (Stanford University 2013). Large populations of this species have the potential to reduce populations of native invertebrates through predation, thereby altering the structure of fresh and brackish water communities. In addition, the species may adversely affect salmonid populations through consumption of eggs and larvae. The crab's foraging activity could also result in the indirect mortality of salmonid eggs and larvae by exposing them to other predators and/or unfavorable conditions (Culver 2005).

New Zealand mud snails (*Potamopyrgus antipodarum*), which reproduce rapidly and can crowd out the native insects that aquatic wildlife depend on for survival, were first discovered in California in 2000 in the Owens River in Mono County (CDFG 2008b). In New Zealand, populations likely are kept in check naturally by a native parasite that is not present in North America. In the absence of such natural predators or parasites, population densities can reach nearly 1 million snails per square meter, and the species is parthenogenic (i.e., able to start a new population from only one snail) (CDFG 2008b). Biologists do not believe that the species can be eradicated once established (CDFG 2008b). Although this species has not yet been recorded in the planning area, it has been located across the Bay to the east in Alameda County (Benson 2011).

The American bullfrog has been accidentally and intentionally introduced (e.g., for food in the 1920s by commercial frog farmers) throughout the world and is now established throughout most of the western

United States (California Herps 2013), including the planning area. Their large size, mobility, generalized eating habits (their prey includes native amphibians as well as other aquatic and riparian vertebrates [Graber 1996]), and aggressive behavior have made bullfrogs extremely successful invaders and a threat to biodiversity (AmphibiaWeb 2008).

Non-native species such as feral house cats (*Felis felis*), red foxes, and Norway rats are known to occur in the planning area and are significant predators of native birds. For example, non-native Norway rats have long been known to be effective predators of clapper rail nests (DeGroot 1927, Harvey 1980, Foerster et al. 1990), and according to Harvey and Foerster et al., predators, especially rats, have accounted for clapper rail nest losses of 24 to 29 percent in certain South Bay marshes.

Section 9.0 Sensitive and Regulated Plant Communities and Habitats

The CDFW ranks certain rare or threatened plant communities, such as wetlands, meadows, and riparian forest and scrub, as 'threatened' or 'very threatened'. These communities are tracked in the CNDDB. Impacts on CDFW sensitive plant communities, or any such community identified in local or regional plans, policies, and regulations, must be considered and evaluated under the CEQA (California Code of Regulations: Title 14, Div. 6, Chap. 3, Appendix G). Furthermore, wetland and riparian habitats are also afforded protection under applicable federal, state, or local regulations, and are generally subject to regulation, protection, or consideration by the USACE, RWQCB, CDFW, and/or the USFWS. EFH is identified and regulated by the NMFS in collaboration with regional, state and local agencies, and is defined as any habitat that is essential to the long-term survival and health of United States fisheries.

9.1 CDFW Natural Communities of Special Concern

A query of sensitive habitats in Rarefind (CNDDB 2013) was performed for the *Palo Alto* USGS 7.5-minute quadrangle in which the planning area occurs and surrounding quadrangles. The CNDDB identified five sensitive habitats as occurring within the nine-quadrangle planning area vicinity: north central coast California roach/stickleback/steelhead stream, north central coast steelhead/sculpin stream, serpentine bunchgrass, northern coastal salt marsh, and valley oak woodland. One of these communities of special concern, northern coastal marsh, was determined to be present within the planning area, and is discussed in detail in *Section 4.1 Northern Coastal Salt Marsh*.

9.2 Waters of the U.S./State

As discussed under *Regulatory Setting* above, a delineation to determine the precise locations and boundaries of jurisdictional waters was not performed for the purposes of this report. However, all marsh habitat types (i.e. northern coastal, non-tidal/diked, brackish, and freshwater) and all open water habitats are likely to meet the definition of waters of the U.S. and would be regulated under Section 404 of the Clean Water Act. The lower portion of San Francisquito Creek, from approximately the U.S. 101 crossing east, is also tidally influenced and would be regulated under Section 10 of the Rivers and Harbors Act.

9.3 CDFW Stream/Riparian Habitat

The bed and banks of San Francisquito Creek, as well as associated riparian habitat, are regulated by the CDFW per §1602 of the Fish and Game Code. Any work within the bed or banks of San Francisquito Creek, or within adjacent riparian habitat, would require a Streambed Alteration Agreement from the CDFW.

9.4 City of East Palo Alto Tree Protection Ordinance

Although no formal tree survey has been conducted, there are likely many trees in the planning area that are subject to the City of East Palo Alto Tree Protection Ordinance. As discussed under *Regulatory Setting* above, any projects within the planning area that have the potential to impact trees of ordinance size must obtain a tree removal permit from the City of East Palo Alto.

9.5 Essential Fish Habitat

As discussed under *Regulatory Setting* above, the San Francisco Bay is officially listed as EFH for the Pacific Coast Salmon FMP. In addition, a number of fish species regulated by the Coastal Pelagics and Pacific Groundfish FMPs are expected to occasionally disperse upstream into the reaches of tidal sloughs in the planning area. Thus, the NMFS would likely consider tidal waters within the planning area to be EFH related to all Pacific Coast Salmon, Coastal Pelagics, and Pacific Groundfish FMPs.

Section 10.0 References

Adams, P.B., C. Grimes, J.E. Hightower, S.T. Lindley, M.L. Moser, and M.J. Parsley. 2007. Population status of North American green sturgeon, *Acipenser medirostris*. Environmental Biology of Fishes 79:339-356.

Alpine A.E. and J.E. Cloern. 1992. Trophic interactions and direct physical effects control phytoplankton biomass and production in an estuary. Limnol Oceanogr (37): 946-955.

AmphibiaWeb. 2008. Introduced species. Available at http://amphibiaweb.org/declines/IntroSp.html. Accessed on 14 August 2013.

Anderson, P. 1995. Biological assessment of San Francisquito Creek Watershed to document status of steelhead trout prior to removal of barriers to migration. California Department of Fish and Game, Memorandum.

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, editors. 2012. The Jepson Manual: Vascular Plants of California, second edition. University of California Press, Berkeley, CA.

Baron, T. and J. Takegawa. 1994. California least tern *Sterna antillarum browni*. Pages 184-187 in C. G. Thelander, D. C. Pearson, and G. E. Olson, editors. Life on the edge: A Guide to California's Endangered Natural Resources.

Barry, S. 1994. The distribution, habitat, and evolution of the San Francisco garter snake, *Thamnophis sirtalis tetrataenia*. Unpublished Masters Dissertation, UC Davis, 143 pages.

Basham, M.P. and L.R. Mewaldt. 1987. Salt water tolerance and the distribution of South San Francisco Bay song sparrows. Condor 89:697-709.

Baxter, R., R. Breuer, L. Brown, L. Conrad, F. Feyrer, S. Fong, K. Gehrts, L. Grimaldo, B. Herbold, P. Hrodey, A. Mueller-Solger, T. Sommer, K. Souza. 2010. Interagency Ecological Program 2010 Pelagic organism decline work plan and synthesis of results through August 2010. Interagency Ecological Program for the San Francisco Estuary. 125 pages.

Beamesderfer, R.C.P., M.L. Simpson, and G.J. Kopp. 2007. Use of life history information in a population model for Sacramento green sturgeon. Environmental Biology of Fishes 79:315-337.

Benson, A.J. 2011. New Zealand mudsnail sightings distribution. Retrieved 8/14/2013 from newzealandmudsnaildistribution.aspx.

Bias, M.A. 1994. Ecology of the Salt Marsh Harvest Mouse in San Pablo Bay. Unpubl. Ph.D. dissertation. University of California. Berkeley, California. 243 p.

Bousman, W.G. 2007a. Black Skimmer *Rynchops niger*. Pp 199-203 in: Bousman, W. G. (ed.). Breeding Bird Atlas of Santa Clara County. Santa Clara Valley Audubon Society, Cupertino, California. 547 pp.

Bousman, W.G. 2007b. Golden eagle *Aquila chrysaetos*. In W.G. Bousman, editor. Breeding Bird Atlas of Santa Clara County. p 184-185. Santa Clara Valley Audubon Society, Cupertino, CA.

Buehler, D.A. 2000. Bald eagle (*Haliaeetus leucocephalus*) in A. Poole and F. Gill, editors. The Birds of North America. The Birds of North America, Inc., Philadelphia.

Bulger, J.B., and N.J. Scott, Jr. 2003. Terrestrial activity and conservation of adult California red-legged frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85-95.

Bury, R.B. and D.J. Germano. 2008. *Actinemys marmorata* (Baird and Girard 1852) - western pond turtle, Pacific pond turtle in G. J. Rhodin, C. H. Pritchard, P. P. van Dijk, R. A. Saumure, K. A. Buhlmann, and J. B. Iverson, editors. Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs.

Cade, T.J. and C.P. Woods. 1997. Changes in distribution and abundance of the loggerhead shrike. Conservation Biology 11:21-31.

Calflora. 2013. Website. Available at: http://www.calflora.org/index.html.

California Herps. 2013. *Lithobates catesbeianus* – American bullfrog. http://www.californiaherps.com/frogs/pages/r.catesbeiana.html. Accessed 17 August 2013.

[CAL-IPC] California Invasive Plant Council. 2013. California Invasive Plant Inventory Database. Available at: http://www.cal-ipc.org/paf/.

Carlton J.T. 1975. Introduced intertidal invertebrates. R.I. Smith and J. Carlton, Light's Manual: Intertidal invertebrates of the Central California Coast. Berkeley, CA: University of California Press. p 17- 25.

Carlton J.T. 1979a. History, Biogeography, and Ecology of the Introduced Marine and Estuarine Invertebrates of the Pacific Coast of North America [Ph.D.]. Davis, CA: University of California, Davis. pp. 904 p.

Carlton J.T. 1979b. Introduced invertebrates of San Francisco Bay. In: Cosmos T.J, editor. San Francisco Bay: The Urbanized Estuary: Pacific Div./Amer. Associ. Adv. Sci., San Francisco. p 427-444.

Carlton J.T, J.K. Thompson, L.E. Schemel, and F.H. Nichols. 1990. Remarkable invasion of San Francisco Bay California USA by the Asian clam *Potamocorbula amurensis* I. Introduction and dispersal. Marine Ecology Progress Series 66(1-2):81-95.

Carraway, L. N., and B. J. Verts. 1991. *Neotoma fuscipes*. Mammalian Species No. 386.

Carter, H.R. and R.A. Erickson. 1992. Status and conservation of the marbled murrelet in California, 1892-1987. In H.R. Carter and M.L. Morrison (eds.). Status and conservation of the marbled murrelet in North America. Proc. West. Found. Vert. Zool. 5:92-108.

[CDFG] California Department of Fish and Game. 1995. Staff report on burrowing owl mitigation.

[CDFG] California Department of Fish and Game. 2008a. Invasive species program. Available at http://www.dfg.ca.gov/invasives/. Accessed on 14 August 2013.

[CDFG] California Department of Fish and Game, 2008b. DFG seeks assistance in slowing spread of New Zealand mud snails. Available at: http://www.dfg.ca.gov/news/news08/08001.html Accessed November 2008.

[CDFG] California Department of Fish and Game. 2008c. Bald eagles in California. Available at http://www.dfg.ca.gov/wildlife/species/t_e_spp/bald_eagle/index.html. Accessed 17 December 2008.

[CDFG] California Department of Fish and Game. 2009. A status review of the longfin smelt (*Spirinchus thaleichthys*) in California. Report to the Fish and Game Commission. California Department of Fish and Game.

Chan, Y. and H. Spautz. 2008. Alameda song sparrow (*Melospiza melodia pusillula*) in W. D. Shuford and T. Gardali, editors. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo, California.

City of East Palo Alto. 1999. City of East Palo Alto General Plan. December 1999.

City of East Palo Alto. 2012. Ravenswood/4 Corners TOD Specific Plan Final EIR. July 2012.

City of Palo Alto. 2006. San Francisquito Creek Bank Stabilization Master Plan. Available at https://city.palo-alto.ca.us/gov/topics/projects/env/jpa/stabilization.asp.

[CNDDB] California Natural Diversity Database. 2013. Rarefind. California Department of Fish and Wildlife, Biogeographic Data Branch.

[CNPS] California Native Plant Society. 2013. Inventory of rare and endangered plants of California (7th edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. Available at: http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi.

Cohen A.N. 1998. Ships' ballast water and the introduction of exotic organisms into the San Francisco Estuary: current status of the problem and options for management. Richmond, California: San Francisco Estuary Institute.

Collins, C., and K. Garrett. 1996. The black skimmer in California: An overview. Western Birds 27:127-135.

Consortium of California Herbaria. 2013. Available at: http://ucjeps.berkeley.edu/consortium/.

Culver, C.S. 2005. Assessing the Potential for Chinese Mitten Crab Predation on Eggs and Larvae of Salmonids. Prepared for U.S. Fish and Wildlife Service. March 2005.

Dege, M. and L.R. Brown. 2004. Effect of outflow on spring and summertime distribution and abundance of larval and juvenile fishes in the upper San Francisco Estuary. Pages 49-65 in L.R.B. Feyrer, R.L. Brown, and J.J. Orsi, editor. Early life history of fishes in the San Francisco Estuary and watershed. American Fisheries Society, Bethesda, Maryland.

DeGroot, D.S. 1927. The California clapper rail: It's nesting habitats, enemies, and habitat. Condor. 29:259-270

Dunk, J. R. 1995. White-tailed Kite (*Elanus leucurus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/178.

Dunk, J.R. and R.J. Cooper. 1994. Territory-size regulation in black-shouldered kites. Auk 111:588-595.

eBird. View and Explore Data. http://ebird.org/ebird/eBirdReports?cmd=Start. Accessed August 2013.

ECORP. 2012. NOAA ARRA Tidal Marsh Restoration Project San Francisco Bay Estuary: South Bay Acoustic Tagged Fish Monitoring Study. Ducks Unlimited Project Number US-CA-446-5.

EDAW, Inc. 2007. Draft Alviso Slough Restoration Project Fisheries and Aquatic Resources Technical Report.

EDAW, Philip Williams and Associates, Ltd., H. T. Harvey & Associates, Brown and Caldwell, and Geomatrix. 2007. South Bay Salt Pond Restoration Project Final Environmental Impact Statement/Report. December 2007.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Erichsen, E.L., K.S. Smallwood, A. M. Commandatore, B. W. Wilson, and M. D. Fry. 1996. White-tailed kite movement and nesting patterns in an agricultural landscape in D. Bird, D. Varland, and J. Negro, editors. Raptors in Human Landscapes. Academic Press, San Diego, California.

ESA PWA, H. T. Harvey & Associates, and S.S. Papadopulos & Associates, Inc. 2011. Cooley Landing Salt Pond Restoration Year 10 Monitoring Report.

Evens, J.G., G.W. Page, S.A. Laymon, and R.W. Stallcup. 1991. Distribution, relative abundance, and status of the California black rail in western North America. Condor 93:952-966.

Feeney, L.R. and W.A. Maffei. 1991. Snowy Plovers and their Habitat at the Baumberg Area and Oliver Salt Ponds Hayward, California March 1989 through May 1990. Report prepared for the City of Hayward.

Fellers, G.M. 2005. Rana draytonii California red-legged frog. Pages 552-554 in M. Lannoo, editor. Amphibian declines: The conservation status of United States species. University of California Press, Berkeley, California.

Fellers, G.M. and P.M. Kleeman. 2007. California red-legged frog (*Rana draytonii*) movement and habitat use: Implications for conservation. Journal of Herpetology 41:276-286.

Findley, J.S. 1955. Speciation of the wandering shrew. Occasional Papers of the Museum of Natural History 9:1-68.

Fitton, S.D. 2008. Bryant's savannah sparrow (*Passerculus sandwichensis alaudinus*) in W. D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo, California.

Foerster, K.S, J.E. Takekawa, and J.D. Albertson. 1990. Breeding density, nesting habitat, and predators of the California Clapper Rail. Fremont, CA: Unpubl. Rep. No. Refuge-116400-90-1, San Francisco Bay Wildlife Refuge. Newark, California. 21+ p.

Garcia-Rossi, D., and D. Hedgecock. 2002. Provenance Analysis of Chinook salmon (*Oncorhynchus tshawytscha*) in the Santa Clara Valley Watershed. Unpublished report prepared by Bodega Marine Laboratory, University of California, Davis. Bodega Bay, CA. 25 pp.

Gardali, T. and J.G. Evens. 2008. San Francisco common yellowthroat (*Geothlypis trichas sinuosa*) in W. D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo and Sacramento, California.

Geissel, W., H. Shellhammer, and H. T. Harvey. 1988. The ecology of the salt-marsh harvest mouse (*Reithrodontomys raviventris*) in a diked salt marsh. Journal of Mammalogy 69(4):696-703.

Goals Project. 1999. Baylands ecosystem habitat goals. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency and San Francisco Bay Regional Water Quality Control Board.

Good, R.E., R.M. Nielson, H. Sawyer, and L.L. McDonald. 2007. A population estimate for golden eagles in the western United States. Journal of Wildlife Management 71:395-402.

Graber, D.M. 1996. Status of terrestrial vertebrates. In Sierra Nevada Ecosystem Project: Final report to Congress. Chapter 25. Davis, California: Centers for Water and Wildland Resources.

Guzy, M.J. and G. Ritchison. 1999. Common yellowthroat (*Geothlypis trichas*) in A. Poole and F. Gill, editors. The Birds of North America. The Birds of North America, Inc., Philadelphia.

H. T. Harvey & Associates. 1989. Ravenswood Redevelopment Project Environmental Impact Report Biotic Elements. Prepared for Wallace, Roberts & Todd. December 1989.

H. T. Harvey & Associates. 1990a. San Jose permit assistance program California clapper rail 1990 breeding survey. Prepared for CH2M Hill.

H. T. Harvey & Associates. 1990b. San Jose permit assistance program California clapper rail 1990 winter survey. Prepared for CH2M Hill.

H. T. Harvey & Associates. 1991. Special Status Wildlife Species Report for the Ravenswood Industrial Area.

H. T. Harvey & Associates. 1998. Cooley Landing Wetland Restoration Biological Assessment.

H. T. Harvey & Associates. 2008. Adobe Creek Reach 5 Woodrat Mitigation Project Report. Project No. 2961-02. Prepared for the Santa Clara Valley Water District and the California Department of Fish and Game.

H. T. Harvey & Associates. 2009. San Francisquito Creek Flood Reduction Alternatives Analysis Project – Biotic Constraints and Opportunities Assessment.

Hall, E.R. 1981. The mammals of North America. 2nd edition. Volume II. John Wiley and Sons, New York, New York.

Hanna G.D. 1966. Introduced mollusks of Western North America. Occ. Paper California Academy of Science 48:108.

Harding-Smith, E.K. 1993. Summary of California Clapper Rail Winter Populations in the San Francisco Bay, 1989 to 1993. U.S. Fish and Wildlife Service.

Harvey, T.E. 1980. A breeding season survey of the California clapper rail (*Rallus longirostris obsoletus*) in South San Francisco Bay, California. Prepared for the U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge.

Harvey H.T, J. Haltiner, and P. Williams. 1982. Guidelines for Enhancement and Restoration of Diked Historic Baylands. Prepared for San Francisco Bay Conservation and Development Commission.

Haynie, M. L., C. F. Fulhorst, M. Rood, S. G. Bennett, B. D. Hess, and R. D. Bradley. 2007. Genetic variation in multilocus microsatellite genotypes in two species of woodrats (*Neotoma macrotis* and *N. fuscipes*). California Journal of Mammalogy 88:745-758.

Hobbs, J.A., P. Moyle, and N. Buckmaster. 2012. Monitoring the response of fish communities to salt pond restoration: Final report. Prepared for the South Bay Salt Pond Restoration Program and Resource Legacy Fund. University of California, Davis, California

Humple, D. 2008. Loggerhead shrike (*Lanius ludovicianus*) (mainland populations) in W. D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo and Sacramento, California.

Hunter, J.E., D. Fix, G.A. Schmidt, and J.C. Power. 2005. Atlas of the breeding birds of Humboldt County, California. Redwood Region Audubon Society, Eureka, California.

ICF International. 2012. San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project San Francisco Bay to Highway 101. Prepared for San Francisquito Creek Joint Powers Authority. October 2012.

Jacques, D.L., C.S. Strong, and T.W. Keeney. 1996. Brown pelican roosting patterns and responses to disturbance at Mugu Lagoon and other nonbreeding sites in the Southern California Bight. University of Arizona Cooperative Park Studies Unit Technical Report No. 54

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. California Department of Fish and Game, Inland Fisheries Division.

Johnston, R.F. 1954. Variation in breeding season and clutch size in song sparrows of the Pacific Coast. Condor 56:268-273.

Johnston, R.F. 1956. Population structure in salt marsh song sparrows. Part I. Environment and annual cycle. Condor 56:268-273.

Jones & Stokes. 2006. Lower San Francisquito Creek Watershed Aquatic Habitat Assessment and Limiting Factors Analysis.

Josselyn M., A. Hatch, C. Strong, and F. Nichols. 2004. Impact of invasive species and other nuisance species. Unpublished science synthesis for the Science Team of the South Bay Salt Pond Restoration Project.

Kelly, J.T., A.P. Klimley, and C.E. Crocker. 2007. Movements of green sturgeon, *Acipenser medirostris*, in the San Francisco Bay Estuary, California. Environmental Biology of Fishes 79:281-295.

Kochert, M.N., K. Steenhof, C.L. Mcintyre, and E.H. Craig. 2002. Golden eagle (*Aquila chrysaetos*) in A. Poole and F. Gill, editors. The Birds of North America. The Birds of North America, Inc., Philadelphia.

Larson, J., T. McKeon, T. Salamunovich, and T.D. Hofstra. 1983. Water quality and productivity of the Redwood Creek estuary. Pages 10-199 in C. Van Riper, L.D. Whittig, and M.I. Murphy, eds. Proc. 1st Biennial Conf. Res. Califo. Natl. Parks, Davis, Calif: National Park Service.

Layne, V.L., R.J. Richmond, and P. Metropulos. 1996. First nesting of black skimmers on San Francisco Bay. Western Birds 27:159-162.

Lee, D.E. and W.D. Tietje. 2005. Dusky-footed woodrat demography and prescribed fire in a California oak woodland. Journal of Wildlife Management 69:1211-1220.

Leidy, R.A. 2007. Ecology, Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California. San Francisco Estuary Institute.

Leidy, R.A., G.S. Becker, and B.N. Harvey. 2003. Historical distribution and current status of steelhead (*Oncorhynchus mykiss*), coho salmon (*Oncorhynchus kisutch*), and Chinook salmon (*Oncorhynchus tshawytscha*) in streams of the San Francisco Estuary, California. Unpubl. report, U.S. Environmental Protection Agency.

Leidy, R.A., G.S. Becker, B.N. Harvey. 2005. Historical distribution and current status of steelhead/rainbow trout (*Oncorhynchus mykiss*) in streams of the San Francisco Estuary, California. Center for Ecosystem Management and Restoration, Oakland, California.

Marschalek, D.A. 2008. California least tern breeding survey, 2007 season. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report 2008-01.

Marriott, M.A. 2003. Microhabitat characteristics predictive of snowy plover (*Charadrius alexandrinus nivosus*) nest site selection in South San Francisco Bay. Master's thesis, Humboldt State University.

McGinnis S.M. 1984. Freshwater fishes of California: University California Press, Berkeley, pp 316.

Menges, T. 1998. Common yellowthroat (*Geothlypis trichas*) in The Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian-associated Birds in California. California Partners in Flight.

Miller, K.J. 1994. Endangered and threatened wildlife and plants; Proposed endangered status for the California red-legged frog. Federal Register 59:4888-4895.

Mills, G.S., J.B. Dunning, Jr., and J.M. Bates. 1989. Effects of urbanization on breeding bird community structure in southwestern desert habitats. Condor 91:416-429.

Moyle P.B. 1976. Fish introductions in California: History and impact on native fishes. Biological Conservation 9:101-118.

Moyle, P.B. 2002. Inland Fishes of California. University of California Press, Davis, California.

Murphy, D.D. and P.R. Ehrlich. 1980. Two California checkerspot butterfly subspecies: one new, one on the verge of extinction. Journal of the Lepidopterists' Society 34:316-230.

Neuman, K.K., G.W. Page, L.E. Stenzel, J.C. Warriner, and S. Warriner. 2004. Effect of mammalian predator management on snowy plover breeding success. Waterbirds 27:257-263.

Nichols F.H, J.E. Cloern, S.N. Luoma, D.H. Peterson. 1986. The modification of an estuary. Science 231(4738):567-573.

Nichols F.H. and M.M. Pamatmat. 1988. The Ecology of the Soft-Bottom Benthos of San Francisco Bay California USA a Community Profile. U S Fish Wildl Serv Biol Rep 85(719):1-74.

[NMFS] National Marine Fisheries Service. 1997. Endangered and Threatened Species: Listing of several Evolutionary Significant Units (ESUs) of West Coast Steelhead. Federal Register 62:43937-43954.

[NMFS] National Marine Fisheries Service. 2000. Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California. Final rule. Federal Register 65:7764-7787.

[NMFS] National Marine Fisheries Service. 2005. Endangered and threatened species: Designation of critical habitat for seven evolutionarily significant units of Pacific steelhead and salmon in California. Final rule. Federal Register 70:52488-52626.

[NMFS] National Marine Fisheries Service. 2006a. Endangered and Threatened Wildlife and Plants; Threatened status for Southern Distinct Population Segment of North American Green Sturgeon. Federal Register 67:17757-17766.

[NMFS] National Marine Fisheries Service. 2009. Endangered and threatened wildlife and plants: final rulemaking to designate critical habitat for the threatened southern distinct population segment of North American green sturgeon: Final Rule. Federal Register 74:52300-52351.

Nur, N., S. Zack, J. Evans, and T. Gardali. 1997. Tidal Marsh Birds of the San Francisco Bay Region: Status Distribution, and Conservation of Five Category 2 Taxa. PRBO Conservation Science final draft report to the United States Geological Survey.

Olofson Environmental, Inc. 2011. California Clapper Rail Surveys for the San Francisco Estuary Invasive Spartina Project 2011. Prepared for the State Coastal Conservancy San Francisco Estuary Invasive Spartina Project. December 2011.

Pacific Fishery Management Council. 1999. Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon and California as Revised through Amendment 14. Portland, Oregon.

Page, G. W., C.M. Hickey, and L.E. Stenzel. 2000. Western snowy plover. Pages 281-283 in P. R. Olofson, editor. Goals Project. Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements of Key Plants, Fish and Wildlife. San Francisco Bay Area Wetlands Ecosystem Goals Project and San Francisco Bay Regional Water Quality Control Board, Oakland, California.

Painter R.E. 1966. Zoobenthos of San Pablo and Suisun bays. Pages 40-56 in Kelley, D.W. (ed.), Ecological studies of the Sacramento-San Joaquin Estuary. Sacramento, CA: Fisheries Bulletin 133, California Department of Fish and Game.

Peeters, H. and P. Peeters. 2005. Raptors of California. University of California Press, Berkeley and Los Angeles, California.

Pierson, E.D., W.E. Rainey, and C. Corben. 2006. Distribution and status of western red bats (*Lasiurus blossevillii*) in California. California Department of Fish and Game, Habitat Conservation Branch, Species Conservation and Recovery Program Report 2006-04.

Polite, C. 1990. Black-shouldered Kite *Elanus caeruleus*. In California's Wildlife, Vol II: Birds. D. C. Zeiner, W. F. Laudenslayer Jr., K.E. Mayer, and M. White, Eds. California Department of Fish and Game, California Statewide Wildlife Habitat Relationships System. Pp 120-121.

PRBO Conservation Science. 2011. 2011 Annual Report to U.S. Fish and Wildlife Service: California Clapper Rail (*Rallus longirostris obsoletus*) TE-807078-12.

PRISM Climate Group. 2013. PRISM Products Matrix., http://prism.oregonstate.edu. Accessed August 2013.

Recher H.F. 1966. Some aspects of the ecology of migrant shorebirds. Ecology 47(393-407).

Rigney, M., and S. L. Granholm. 1990. Least tern *Sterna antillarum* in D. C. Zeiner, W. F. Laudenslayer Jr., K. E. Mayer, and M. White, editors. California's Wildlife. Vol. II: Birds. California Department of Fish and Game, California Statewide Wildlife Habitat Relationships System.

Robinson, A. and B.K. Greenfield. 2011. LTMS Longfin Smelt Literature Review and Study Plan. San Francisco Estuary Institute. Prepared for the Long-term Management Strategy for Dredged Materials in San Francisco Bay.

Robinson-Nilsen, C., J.B. Demers, and C. Strong. 2010. Western Snowy Plover Numbers, Nesting Success, Fledging Success and Avian Predator Surveys in the San Francisco Bay, 2010. 30 December 2010.

Rosenberg, D.K., L.A. Trulio, D. Catlin, D. Chromczack, J.A. Gervais, N. Ronan, and K.A. Haley. 2007. The Ecology of the Burrowing Owl in California. Unpubl. report prepared for the Bureau of Land Management.

Rosenfield, J.A. 2009. Distribution and abundance trends of Longfin smelt in the San Francisco Estuary. Green Sturgeon, Longfin Smelt, and Dredging Operations Symposium. San Francisco Estuary Institute, Oakland, California.

Rosier, J.R., N.A. Ronan, and D.K. Rosenberg. 2006. Post-breeding dispersal of burrowing owls in an extensive California grassland. American Midland Naturalist 155:162-167.

San Francisco Estuary Institute. 2009. Historical Ecology of the Lower San Francisquito Creek Phase 1. Prepared for the San Francisquito Creek Joint Powers Authority.

San Francisco Bay Bird Observatory. 2012. Determining the Breeding Extent of the San Francisco Common Yellowthroat and the Alameda Song Sparrow in Santa Clara County, California. December 2012.

Sequoia Audubon Society. 2001. San Mateo County Breeding Bird Atlas.

Shellhammer, H. S. 1982. *Reithrodontomys raviventris*. Mammalian Species 169(1-3).

Shellhammer, H.S. 2000. Salt marsh wandering shrew, *Sorex vagrans halicoetes*. Pages 109-113 in P. R. Olofson, editor. Goals Project. Baylands ecosystem species and community profiles: Life histories and environmental requirements of key plants, fish and wildlife. San Francisco Bay Area Wetlands Ecosystem Goals Project. San Francisco Bay Regional Water Quality Control Board, Oakland, California.

Shellhammer, H. S., and R. Duke. 2004. Salt marsh harvest mouse habitat of the South San Francisco Bay: An analysis of habitat fragmentation and escape cover. San Francisco Estuarine Institute.

Shields, M. 2002. Brown pelican (*Pelecanus occidentalis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/609

Shuford, W.D. and T. Gardali, editors. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Western Field Ornithologists and California Department of Fish and Game, Camarillo and Sacramento, California.

Skonieczny, M.F., and J.R. Dunk. 1997. Hunting synchrony in white-tailed kites. Journal of Raptor.

Stanford University. 2013. Stanford University Habitat Conservation Plan. Revised March 2013.

Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. Boston, Massachusetts.

Strong, C.M. 2004. A summary of nesting waterbirds in the San Francisco Bay, from 1982 to 2004. Unpubl. report, San Francisco Bay Bird Observatory.

Takekawa J. 1993. The California clapper rail: turning the tide? Tideline (East Bay Regional Park District) 13(2):1-3, 11.

Taylor D.W. 1981. Freshwater mollusks of California: A distributional checklist. California Fish and Game 67(3):140-163.

Trulio, L.A. and J.G. Evens. 2000. California black rail. Pages 342-345 in P. R. Olofson, editor. Goals Project. Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements of Key Plants, Fish and Wildlife. San Francisco Bay Area Wetlands Ecosystem Goals Project and San Francisco Bay Regional Water Quality Control Board, Oakland, California.

Unitt, P. 1987. Empidonax traillii extimus: An endangered species. Western Birds 18:137-162.

[USFWS] U.S. Fish and Wildlife Service. 1970. Conservation of endangered species and other fish or wildlife: Appendix D. United States list of endangered native fish and wildlife. Federal Register 35:16047-16048.

[USFWS] U.S. Fish and Wildlife Service. 1983. The California Brown Pelican Recovery Plan. U. S. Fish and Wildlife Service. Portland, Oregon. 179 pp.

[USFWS] U.S. Fish and Wildlife Service. 1984. Salt Marsh Harvest Mouse and Clapper Rail Recovery Plan.

[USFWS] U.S. Fish and Wildlife Services. 1996. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Red-legged Frog. Federal Register 61:25813-25833.

[USFWS] U.S. Fish and Wildlife Service. 1997. Final Recovery Plan for Marbled Murrelet (Washington, Oregon, and California Populations).

[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for serpentine soil species of the San Francisco Bay Area.

[USFWS] U.S. Fish and Wildlife Service. 1999a. Endangered and threatened wildlife and plants: Designation of critical habitat for the Pacific Coast population of the western snowy plover; Final rule. Federal Register 64:68508-68544.

[USFWS] U.S. Fish and Wildlife Service. 1999b. Endangered and threatened wildlife and plants: Final rule to remove the American peregrine falcon from the federal list of endangered and threatened wildlife, and to remove the similarity of appearance provision for free-flying peregrines in the conterminus United States; Final rule. Federal Register 64:46542-46558.

[USFWS] U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Region 1.

[USFWS] U.S. Fish and Wildlife Service. 2007. Recovery plan for the Pacific Coast population of the western snowy plover (*Charadrius alexandrinus nivosus*).

[USFWS] U.S. Fish and Wildlife Service. 2008a. Endangered and threatened wildlife and plants; Petition to list the San Francisco-Bay Delta population of the longfin smelt (*Spirinchus thaleichthys*) as endangered; Notice of 90-day petition finding and initiation of status review. Federal Register 73:24911-24915.

[USFWS] U.S. Fish and Wildlife Service. 2008b. Endangered and threatened wildlife and plants: Removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife; Final rule. Federal Register 72:37345-37372.

[USFWS] U.S. Fish and Wildlife Service. 2009a. Endangered and Threatened Wildlife and Plants; Removal of the Brown Pelican (*Pelecanus occidentalis*) From the Federal List of Endangered and Threatened Wildlife; Final Rule. Federal Register: 74(220): 59443-59472. November 17, 2009.

[USFWS] U.S. Fish and Wildlife Service. 2009b. Species account California red-legged frog *Rana aurora draytonii.*

[USFWS] U.S. Fish and Wildlife Service. 2010. Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California. Federal Register: 75(27): 6696-6697. 10 February 2010.

[USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final Rule. Federal Register: 77(118): 36728-36869.

Wang, J.C.S. 1986. Fishes of the Sacramento-San Joaquin Estuary and Adjacent Waters, California: A guide to the Early Life Histories. Bureau of Reclamation. Interagency Ecological Program Technical Report No. 9.

Weiss, S.B. 2002. Final Report on NFWF Grant for Habitat Restoration at Edgewood Natural Preserve, San Mateo County, CA. October 2002.

Western Bat Working Group. 2005. Species accounts *Lasiurus blossevillii*, western red bat. Available at http://www.wbwg.org/speciesinfo/species_accounts/vespertilonidae/labl.pdf.

Western Hemisphere Shorebird Reserve Network. 2009. San Francisco Bay. Available at http://www.whsrn.org/site-profile/san-francisco-bay. Accessed 17 August 2013.

Wheelock, I. G. 1916. Birds of California. A. C. McClurg & Co., Chicago, Illinois.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/231

Zeiner, D.C., W.F. Laudenslayer Jr., K.E. Mayer, and M. White, editors. 1990a. California's Wildlife. Volume II: Birds. California Department of Fish and Game, Sacramento, California.

Zeiner, D.C., W.F. Laudenslayer Jr., K.E. Mayer, and M. White, editors. 1990b. California's Wildlife. Volume III: Mammals. California Department of Fish and Game, Sacramento, California.

10.1.1 Personal Communications

Hall L. 2013. pers. comm. to Scott Demers. 22 January 2013.

Hieb, K. 2012. (CDFW) email message to S. Kramer (H. T. Harvey & Associates), dated 28 August 2012.

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H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Figure 1: Vicinity Map

East Palo Alto General Plan Update (3328-06)
August 2013

H. T. HARVEY & ASSOCIATES
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Figure 2: Planning Area
East Palo Alto General Plan Update (3328-06)
August 2013

CODE	SOIL TYPE
108	Botella-Urban land complex, 0 to 5 percent slopes
117	Novato clay, 0 to 1 percent slopes
118	Novato clay, 0 to 1 percent slopes ponded
121	Orthents, cut and fill, 0 to 15 percent slopes
131	Urban land
132	Urban land-Orthents, cut and fill complex, 0 to 5 percent slopes
134	Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes
139	Water

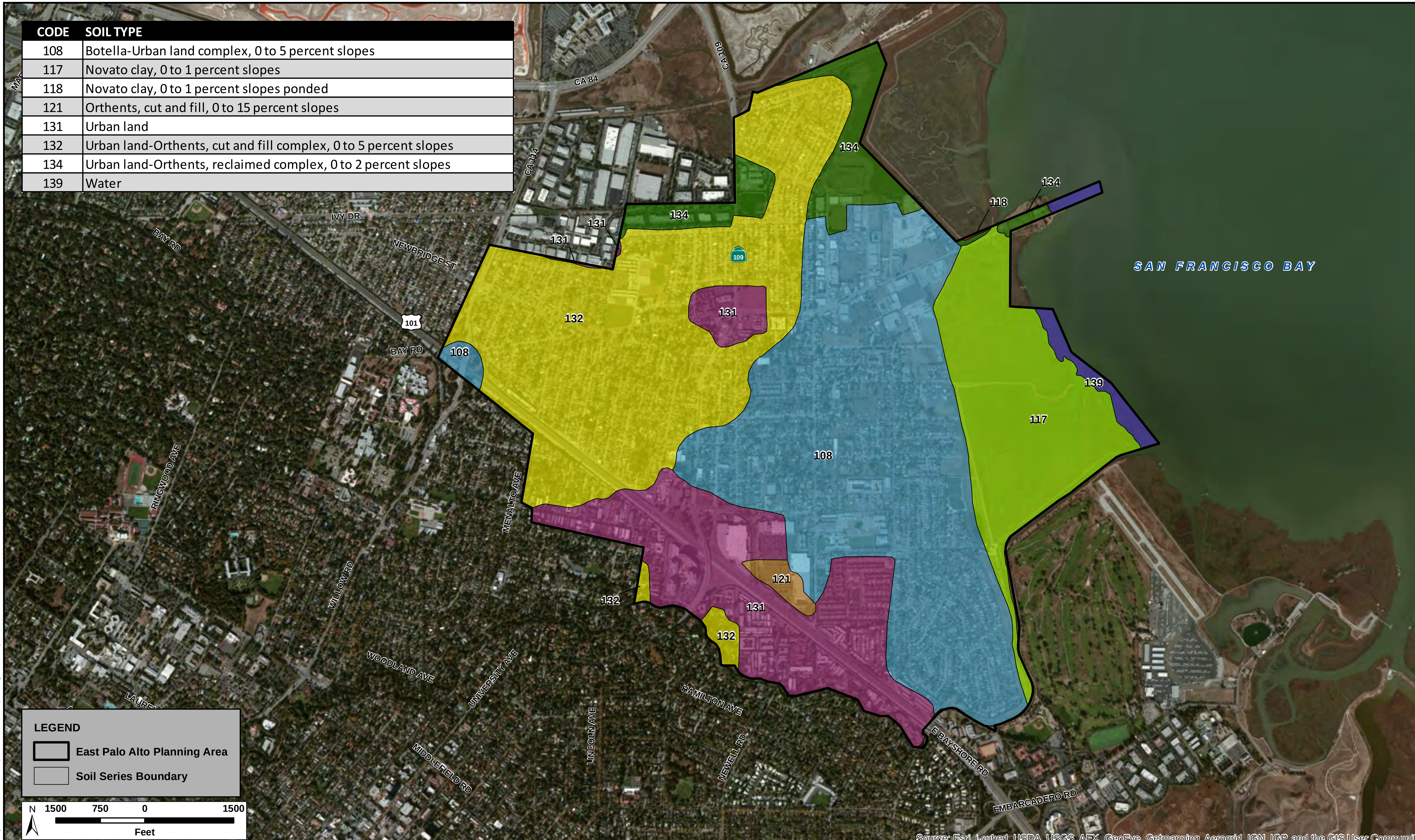

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Figure 3: Soils Map

East Palo Alto General Plan Update (3328-06)

August 2013

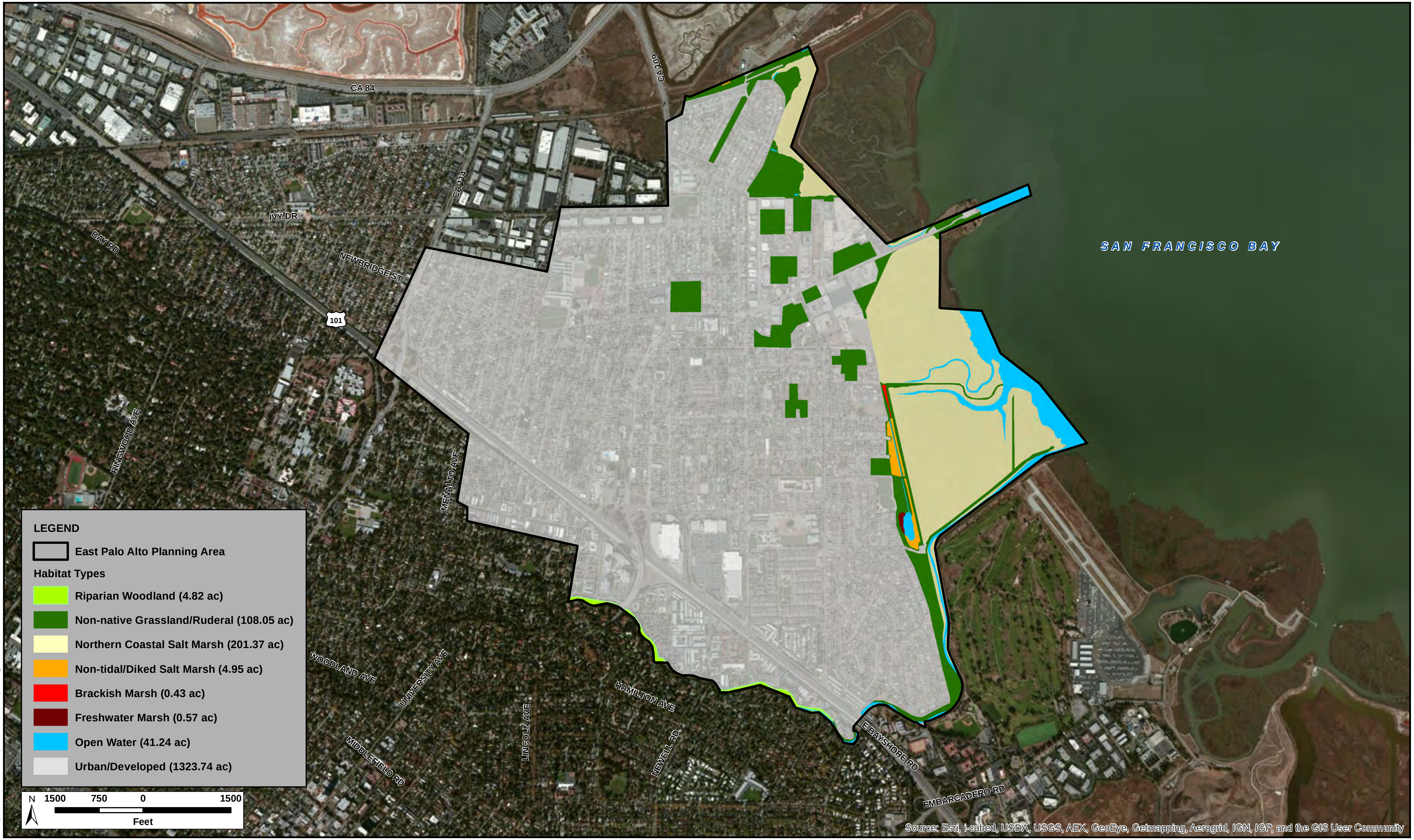

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Figure 4: Habitat Map
East Palo Alto General Plan Update (3328-06)
August 2013

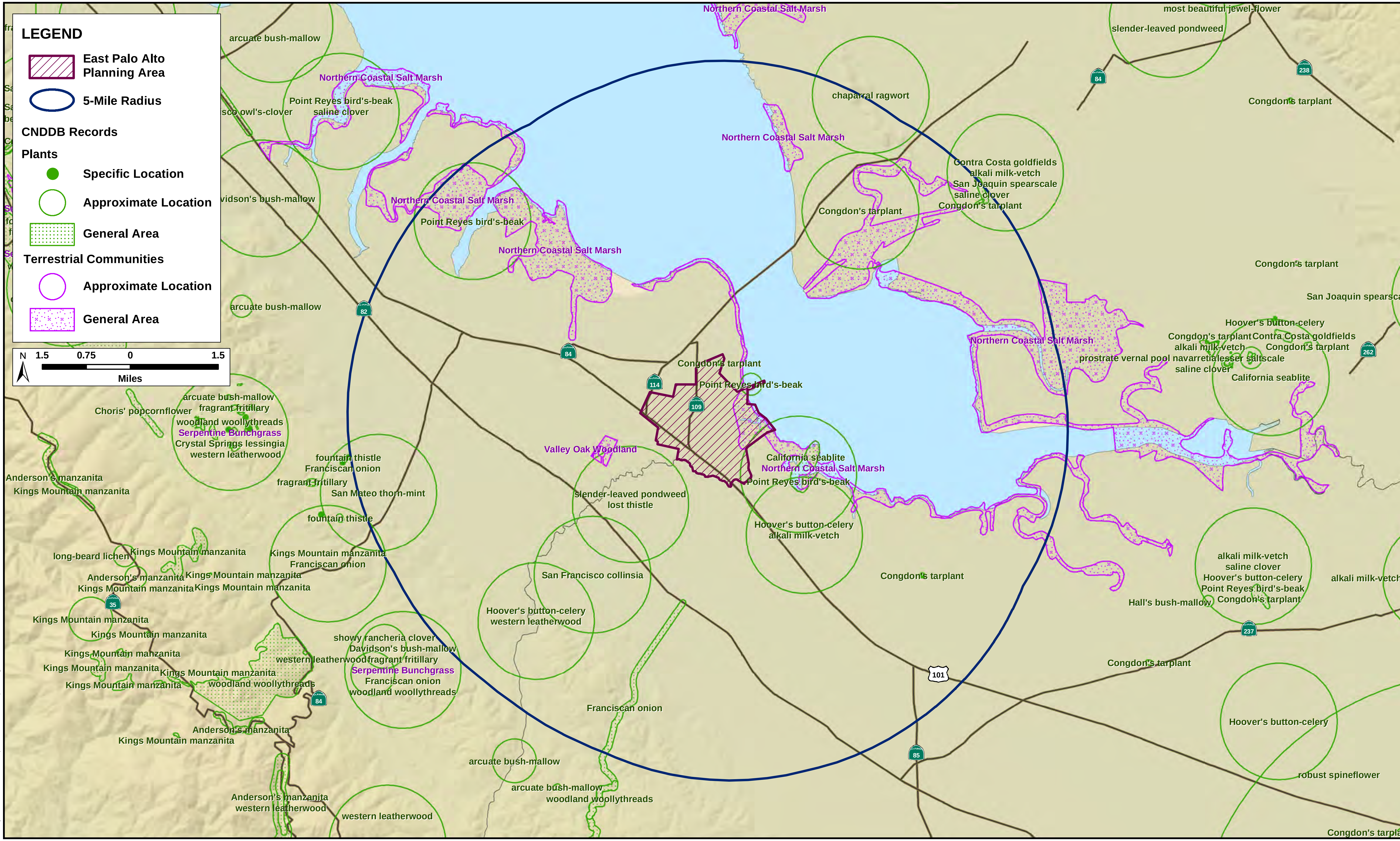

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Figure 5a: CNDDB Plant Records
East Palo Alto General Plan Update (3328-06)
August 2013

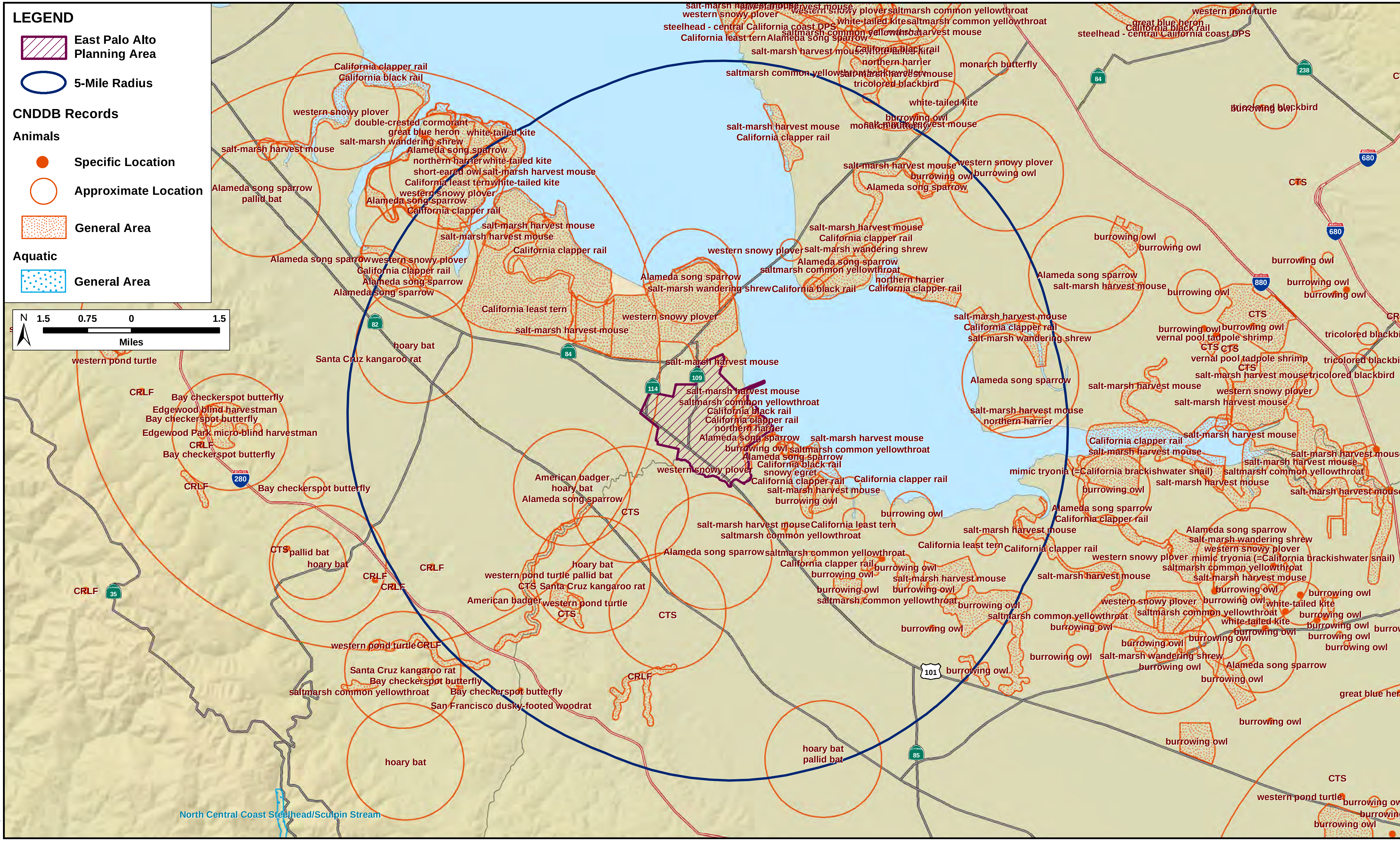

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Figure 5b: CNDDB Animal Records
East Palo Alto General Plan Update (3328-06)
August 2013

Appendix A. Special-Status Plant Species Considered But Rejected for Occurrence in the Planning Area

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Federal or State Endangered, Rare, or Threatened Species			
San Mateo thorn-mint (*Acanthomintha duttonii*)	FE, SE, CNPS 1B.1	Chaparral; valley and foothill grassland/serpentinite. Elevation 164-984 feet.	**Absent.** No suitable habitat is present.
Robust spineflower (*Chorizanthe robusta* var. *robusta*)	FE, CNPS 1B.1	Chaparral (maritime); cismontane woodland (openings); coastal dunes; coastal scrub/sandy or gravelly. Elevation 10-984 feet.	**Absent.** No suitable habitat is present.
Crystal Springs fountain thistle (*Cirsium fontinale* var. *fontinale*)	FE, SE, CNPS 1B.1	Chaparral (openings); cismontane woodland; valley and foothill grassland/serpentinite seeps. Elevation 148-558 feet.	**Absent.** No suitable habitat is present.
San Mateo woolly sunflower (*Eriophyllum latilobum*)	FE, SE, CNPS 1B.1	Cismontane woodland (often serpentinite; on roadcuts). Elevation 148-492 feet.	**Absent.** No suitable habitat is present.
Marin western flax (*Hesperolinon congestum*)	FT, ST, CNPS 1B.1	Chaparral; valley and foothill grassland/serpentinite. Elevation 16-1214 feet.	**Absent.** No suitable habitat is present.
Contra Costa goldfields (*Lasthenia conjugens*)	FE, CNPS 1B.1	Cismontane woodland; playas (alkaline); valley and foothill grassland; vernal pools/mesic. Elevation 0-1542 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and the closest known populations are in Alameda County (CNDDB 2013).
Dudley's lousewort (*Pedicularis dudleyi*)	SR, CNPS 1B.2	Chaparral (maritime); cismontane woodland; north coast coniferous forest; valley and foothill grassland. Elevation 197-2953 feet.	**Absent.** No suitable habitat is present.
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	FE, SE, CNPS 1B.1	Cismontane woodland; valley and foothill grassland (often serpentinite). Elevation 115-2034 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
California seablite (*Suaeda californica*)	FE, CNPS 1B.1	Marshes and swamps (coastal salt). Elevation 0-33 feet.	**Absent.** One historic (1971) occurrence is located approximately 1 mile southeast of the planning area (CNDDB 2013). However, this occurrence has not been observed since it was reported in 1971 (CNDDB 2013), and the species is presumed extirpated from San Mateo County and South San Francisco Bay (CNPS 2013).
Two-fork clover (*Trifolium amoenum*)	FE, CNPS 1B.1	Coastal bluff scrub; valley and foothill grassland (sometimes serpentinite). Elevation 16-1345 feet.	**Absent.** No suitable habitat is present.
California Native Plant Society (CNPS) Rare Species			
Franciscan onion (*Allium peninsulare* var. *franciscanum*)	CNPS 1B.2	Cismontane woodland; valley and foothill grassland/clay; volcanic; often serpentinite. Elevation 171-984 feet.	**Absent.** No suitable habitat is present.
Bent-flowered fiddleneck (*Amsinckia lunaris*)	CNPS 1B.2	Coastal bluff scrub; cismontane woodland; valley and foothill grassland. Elevation 10-1640 feet.	**Absent.** No suitable habitat is present.
California androsace (*Androsace elongata* ssp. *acuta*)	CNPS 4.2	Chaparral; cismontane woodland; coastal scrub; meadows and seeps; pinyon and juniper woodland; valley and foothill grassland. Elevation 492-3937 feet.	**Absent.** No suitable habitat is present.
Coast rockcress (*Arabis blepharophylla*)	CNPS 4.3	Broadleafed upland forest; coastal bluff scrub; coastal prairie; coastal scrub/rocky. Elevation 10-3609 feet.	**Absent.** No suitable habitat is present.
Anderson's manzanita (*Arctostaphylos andersonii*)	CNPS 1B.2	Broadleafed upland forest; chaparral; north coast coniferous forest/openings; edges. Elevation 197-2493 feet.	**Absent.** No suitable habitat is present.
Montara manzanita (*Arctostaphylos montaraensis*)	CNPS 1B.2	Chaparral (maritime); coastal scrub. Elevation 492-1640 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Kings Mountain manzanita (*Arctostaphylos regismontana*)	CNPS 1B.2	Broadleafed upland forest; chaparral; north coast coniferous forest/granitic or sandstone. Elevation 1001-2395 feet.	**Absent.** No suitable habitat is present.
Ocean bluff milk-vetch (*Astragalus nuttallii* var. *nuttallii*)	CNPS 4.2	Coastal bluff scrub; coastal dunes. Elevation 10-394 feet.	**Absent.** No suitable habitat is present.
Coastal marsh milk-vetch (*Astragalus pycnostachyus* var. *pycnostachyus*)	CNPS 1B.2	Coastal dunes (mesic); coastal scrub; marshes and swamps (coastal salt; streamsides). Elevation 0-98 feet.	**Absent.** No suitable habitat is present. Occurs on dunes/sandy soils adjacent to, but not in coastal salt marsh.
Alkali milk-vetch (*Astragalus tener* var. *tener*)	CNPS 1B.2	Playas; valley and foothill grassland (adobe clay); vernal pools/alkaline. Elevation 3-197 feet.	**Absent.** Ruderal grassland could provide marginal habitat and there is a historic (1905) occurrence approximately 1.5 miles southeast of the planning area (CNDDB 2013). However, this species is presumed extirpated from the South San Francisco Bay Area.
Brittlescale (*Atriplex depressa*)	CNPS 1B.2	Chenopod scrub; meadows and seeps; playas; valley and foothill grassland; vernal pools/alkaline; clay. Elevation 3-1050 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and the closest known populations are in Alameda County (CNDDB 2013).
San Joaquin spearscale (*Atriplex joaquinana*)	CNPS 1B.2	Chenopod scrub; meadows and seeps; playas; valley and foothill grassland/alkaline. Elevation 3-2723 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and the closest known populations are in Alameda County (CNDDB 2013).
Lesser saltscale (*Atriplex minuscula*)	CNPS 1B.1	Chenopod scrub; playas; valley and foothill grassland/alkaline; sandy. Elevation 49-656 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and the closest known populations are in Alameda County (CNDDB 2013).
Brewer's calandrinia (*Calandrinia breweri*)	CNPS 4.2	Chaparral; coastal scrub/sandy or loamy; disturbed sites and burns. Elevation 33-4003 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Oakland star-tulip (*Calochortus umbellatus*)	CNPS 4.2	Broadleafed upland forest; chaparral; cismontane woodland; lower montane coniferous forest; valley and foothill grassland/often serpentinite. Elevation 328-2297 feet.	**Absent.** No suitable habitat is present.
Pink star-tulip (*Calochortus uniflorus*)	CNPS 4.2	Coastal prairie; coastal scrub; meadows and seeps; north coast coniferous forest. Elevation 33-3510 feet.	**Absent.** No suitable habitat is present.
Chaparral harebell (*Campanula exigua*)	CNPS 1B.2	Chaparral (rocky; usually serpentinite). Elevation 902-4101 feet.	**Absent.** No suitable habitat is present.
Johnny-nip (*Castilleja ambigua* var. *ambigua*)	CNPS 4.2	Coastal bluff scrub; coastal Prairie; coastal scrub; marshes and swamps; valley and foothill grassland; vernal pools margins. Elevation 0-1411 feet.	**Absent.** No suitable habitat is present.
San Francisco Bay spineflower (*Chorizanthe cuspidata* var. *cuspidata*)	CNPS 1B.2	Coastal bluff scrub; coastal dunes; coastal prairie; coastal scrub/sandy. Elevation 10-689 feet.	**Absent.** No suitable habitat is present.
Lost thistle (*Cirsium praeteriens*)	CNPS 1A	Unknown. Elevation 0-328 feet.	**Absent.** Presumed to be extinct (CNPS 2013).
Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*)	CNPS 4.3	Chaparral; cismontane woodland. Elevation 295-4921 feet.	**Absent.** No suitable habitat is present.
Lewis' clarkia (*Clarkia lewisii*)	CNPS 4.3	Broadleaved upland forest; closed-cone coniferous forest; chaparral; cismontane woodland; coastal scrub. Elevation 98-2001 feet.	**Absent.** No suitable habitat is present.
San Francisco collinsia (*Collinsia multicolor*)	CNPS 1B.2	Closed-cone coniferous forest; coastal scrub/sometimes serpentinite. Elevation 98-820 feet.	**Absent.** No suitable habitat is present.
Clustered lady's-slipper (*Cypripedium fasciculatum*)	CNPS 4.2	Lower montane coniferous forest; north coast coniferous forest/usually serpentinite seeps and streambanks. Elevation 328-7972 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Mountain lady's-slipper (*Cypripedium montanum*)	CNPS 4.2	Broadleafed upland forest; cismontane woodland; lower montane coniferous forest; north coast coniferous forest. Elevation 607-7283 feet.	**Absent.** No suitable habitat is present.
Western leatherwood (*Dirca occidentalis*)	CNPS 1B.2	Broadleafed upland forest; closed-cone coniferous forest; chaparral; cismontane woodland; north coast coniferous forest; riparian forest; riparian woodland/mesic. Elevation 82-1378 feet.	**Absent.** No suitable habitat is present.
California bottle-brush grass (*Elymus californicus*)	CNPS 4.3	Broadleafed upland forest; cismontane woodland; north coast coniferous forest; riparian woodland. Elevation 49-1542 feet.	**Absent.** No suitable habitat is present.
Ben Lomond buckwheat (*Eriogonum nudum* var. *decurrens*)	CNPS 1B.1	Chaparral; cismontane woodland; lower montane coniferous forest (maritime ponderosa pine sandhills)/sandy. Elevation 164-2625 feet.	**Absent.** No suitable habitat is present.
Hoover's button-celery (*Eryngium aristulatum* var. *hooveri*)	CNPS 1B.1	Vernal pools. Elevation 10-131 feet.	**Absent.** No suitable habitat is present. One historic (1909) occurrence is located approximately 1.5 miles southeast of the planning area (CNDDB 2013). However, this species is presumed extirpated from San Mateo and Santa Clara counties (CNPS 2013).
San Francisco wallflower (*Erysimum franciscanum*)	CNPS 4.2	Chaparral; coastal dunes; coastal Scrub; valley and foothill grassland/often serpentinite or granitic; sometimes roadsides. Elevation 0-1804 feet.	**Absent.** No suitable habitat is present.
Stinkbells (*Fritillaria agrestis*)	CNPS 4.2	Chaparral; cismontane woodland; pinyon and juniper woodland; valley and foothill grassland/clay; sometimes serpentinite. Elevation 33-5085 feet	**Absent.** No suitable habitat is present.
Hillsborough chocolate lily (*Fritillaria biflora* var. *ineziana*)	CNPS 1B.1	Cismontane woodland; valley and foothill grassland/serpentinite. Elevation 493 feet.	**Absent.** No suitable habitat is present.
Fragrant fritillary (*Fritillaria liliacea*)	CNPS 1B.2	Cismontane woodland; coastal prairie; coastal scrub; valley and foothill grassland/often serpentinite. Elevation 10-1345 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*)	CNPS 1B.2	Coastal bluff scrub (sandy); coastal dunes; coastal prairie. Elevation 0-689 feet.	**Absent.** No suitable habitat is present.
Loma Prieta hoita (*Hoita strobilina*)	CNPS 1B.1	Chaparral; cismontane woodland; riparian woodland/usually serpentinite; mesic. Elevation 98-2822 feet.	**Absent.** No suitable habitat is present.
Harlequin lotus (*Hosackia gracilis*)	CNPS 4.2	Broadleafed upland forest; coastal bluff scrub; closed-cone coniferous forest; cismontane woodland; coastal prairie; coastal scrub; meadows and seeps; marshes and swamps; north coast coniferous forest; valley and Foothill grassland/wetlands; roadsides. Elevation 0-2297 feet.	**Absent.** No suitable habitat is present. Range is generally restricted to areas within a few miles of the Pacific Ocean, west of the Coast Ranges and Santa Cruz Mountains.
Coast iris (*Iris longipetala*)	CNPS 4.2	Coastal prairie; lower montane coniferous forest; meadows and seeps/mesic. Elevation 0-1969 feet.	**Absent.** No suitable habitat is present.
Legenere (*Legenere limosa*)	CNPS 1B.1	Vernal pools. Elevation 3-2887 feet.	**Absent.** No suitable habitat is present.
Bristly leptosiphon (*Leptosiphon acicularis*)	CNPS 4.2	Chaparral; cismontane woodland; coastal prairie; valley and foothill grassland. Elevation 180-4921 feet.	**Absent.** No suitable habitat is present.
Serpentine leptosiphon (*Leptosiphon ambiguus*)	CNPS 4.2	Cismontane woodland; coastal scrub; valley and foothill grassland/usually serpentinite. Elevation 394-3707 feet.	**Absent.** No suitable habitat is present.
Large-flowered leptosiphon (*Leptosiphon grandiflorus*)	CNPS 4.2	Coastal bluff scrub; closed-cone coniferous forest; cismontane woodland; coastal dunes; coastal prairie; coastal scrub; valley and foothill grassland/usually sandy. Elevation 16-4003 feet.	**Absent.** No suitable habitat is present.
Crystal Springs lessingia (*Lessingia arachnoidea*)	CNPS 1B.2	Cismontane woodland; coastal scrub; valley and foothill grassland/serpentinite; often roadsides. Elevation 197-656 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Woolly-headed lessingia (*Lessingia hololeuca*)	CNPS 3	Broadleafed upland forest; coastal scrub; lower montane coniferous forest; valley and foothill grassland/clay; serpentinite. Elevation 49-984 feet.	**Absent.** No suitable habitat is present.
Coast lily (*Lilium maritimum*)	CNPS 1B.1	Broadleafed upland forest; closed-cone coniferous forest; coastal prairie; coastal scrub; marshes and swamps (freshwater); north coast coniferous forest/sometimes roadside. Elevation 16-1542 feet.	**Absent.** No suitable habitat is present.
San Mateo tree lupine (*Lupinus arboreus* var. *eximius*)	CNPS 3.2	Chaparral; coastal scrub. Elevation 295-1804 feet.	**Absent.** No suitable habitat is present.
Indian Valley bush-mallow (*Malacothamnus aboriginum*)	CNPS 1B.2	Chaparral; cismontane woodland/rocky; granitic; often in burned areas. Elevation 492-5577 feet.	**Absent.** No suitable habitat is present.
Arcuate bush-mallow (*Malacothamnus arcuatus*)	CNPS 1B.2	Chaparral; cismontane woodland. Elevation 49-1148 feet.	**Absent.** No suitable habitat is present.
Davidson's bush-mallow (*Malacothamnus davidsonii*)	CNPS 1B.2	Chaparral; cismontane woodland; coastal scrub; riparian woodland. Elevation 607-2789 feet.	**Absent.** No suitable habitat is present.
Hall's bush-mallow (*Malacothamnus hallii*)	CNPS 1B.2	Chaparral; coastal scrub. Elevation 33-2493 feet.	**Absent.** No suitable habitat is present.
Mt. Diablo cottonweed (*Micropus amphibolus*)	CNPS 3.2	Broadleafed upland forest; chaparral; cismontane woodland; valley and foothill grassland/rocky. Elevation 148-2690 feet.	**Absent.** No suitable habitat is present.
San Antonio Hills monardella (*Monardella antonina* ssp. *antonina*)	CNPS 3	Chaparral; cismontane woodland. Elevation 1640-3281 feet.	**Absent.** No suitable habitat is present.
Curly-leaved monardella (*Monardella undulata*)	CNPS 4.2	Closed-cone coniferous forest; Chaparral; coastal dunes; coastal prairie; coastal scrub; lower montane coniferous forest (ponderosa pine sandhills)/sandy. Elevation 0-984 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Woodland woolythreads (*Monolopia gracilens*)	CNPS 1B.2	Broadleafed upland forest (openings); chaparral (openings); cismontane woodland; north coast coniferous forest (openings); valley and foothill grassland/serpentine. Elevation 328-3937 feet.	**Absent.** No suitable habitat is present.
Pincushion navarretia (*Navarretia myersii* ssp. *myersii*)	CNPS 1B.1	Vernal pools/often acidic. Elevation 66-1083 feet.	**Absent.** No suitable habitat is present.
Prostrate vernal pool navarretia (*Navarretia prostrata*)	CNPS 1B.1	Coastal scrub; meadows and seeps; valley and foothill grassland (alkaline); vernal pools/mesic. Elevation 49-3970 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and the closest known populations are in Alameda County (CNDDB 2013).
Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*)	CNPS 4.2	Broadleafed upland forest; chaparral; coastal prairie; valley and foothill grassland; vernal pools/vernally mesic. Elevation 0-2001 feet.	**Absent.** No suitable habitat is present.
White-flowered rein orchid (*Piperia candida*)	CNPS 1B.2	Broadleafed upland forest; lower montane coniferous forest; north coast coniferous forest/sometimes serpentinite. Elevation 98-4298 feet.	**Absent.** No suitable habitat is present.
Michael's rein orchid (*Piperia michaelii*)	CNPS 4.2	Coastal bluff scrub; closed-cone coniferous forest; chaparral; cismontane woodland; coastal scrub; lower montane coniferous forest. Elevation 10-2986 feet.	**Absent.** No suitable habitat is present.
Choris' popcorn-flower (*Plagiobothrys chorisianus* var. *chorisianus*)	CNPS 1B.2	Chaparral; coastal prairie; coastal scrub/mesic. Elevation 49-525 feet.	**Absent.** No suitable habitat is present.
Hickman's popcorn-flower (*Plagiobothrys chorisianus* var. *hickmanii*)	CNPS 4.2	Closed-cone coniferous forest; chaparral; coastal scrub; marshes and swamps; vernal pools. Elevation 49-591 feet.	**Absent.** No suitable habitat is present.
Hairless popcorn-flower (*Plagiobothrys glaber*)	CNPS 1A	Meadows and seeps (alkaline); marshes and swamps (coastal salt). Elevation 49-591 feet.	**Absent.** Presumed to be extinct (CNPS 2013).
Oregon polemonium (*Polemonium carneum*)	CNPS 2B.2	Coastal prairie; coastal scrub; lower montane coniferous forest. Elevation 0-6004 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Lobb's aquatic buttercup (*Ranunculus lobbii*)	CNPS 4.2	Cismontane woodland; north coast coniferous forest; valley and foothill grassland; vernal pools/mesic. Elevation 49-1542 feet.	**Absent.** No suitable habitat is present.
Hoffmann's sanicle (*Sanicula hoffmannii*)	CNPS 4.3	Broadleafed upland forest; coastal bluff scrub; chaparral; cismontane woodland; coastal scrub; lower montane coniferous forest/often serpentinite or clay. Elevation 98-984 feet.	**Absent.** No suitable habitat is present.
Chaparral ragwort (*Senecio aphanactis*)	CNPS 2B.2	Chaparral; cismontane woodland; coastal scrub/sometimes alkaline. Elevation 48-2625 feet.	**Absent.** No suitable habitat is present.
San Francisco campion (*Silene verecunda* ssp. *verecunda*)	CNPS 1B.2	Coastal bluff scrub; chaparral; coastal prairie; coastal scrub; valley and foothill grassland/sandy. Elevation 98-2100 feet.	**Absent.** No suitable habitat is present.
Most beautiful jewel-flower (*Streptanthus albidus* ssp. *peramoenus*)	CNPS 1B.2	Chaparral; cismontane woodland; valley and foothill grassland/serpentinite. Elevation 308-3281 feet.	**Absent.** No suitable habitat is present.
Slender-leaved pondweed (*Stuckenia filiformis* ssp. *alpina*)	CNPS 2B.2	Marshes and swamps (assorted shallow freshwater). Elevation 984-7054 feet.	**Absent.** No suitable habitat is present.
Marsh zigadenus (*Toxicoscordion fontanum*)	CNPS 4.2	Chaparral; cismontane woodland; lower montane coniferous forest; meadows and seeps; marshes and swamps/vernally mesic; often serpentinite. Elevation 49-3281 feet.	**Absent.** No suitable habitat is present.
Saline clover (*Trifolium hydrophilum*)	CNPS 1B.2	Marshes and swamps; valley and foothill grassland (mesic; alkaline); vernal pools. Elevation 0-984 feet.	**Absent.** Ruderal grassland could provide marginal habitat. There are several historic (1886, 1892, 1903) occurrences from San Mateo and Santa Clara Counties; however there are no recent records in the vicinity (CNDDB 2013).
San Francisco owl's-clover (*Triphysaria floribunda*)	CNPS 1B.2	Coastal prairie; coastal scrub; valley and foothill grassland/usually serpentinite. Elevation 33-525 feet.	**Absent.** No suitable habitat is present.

Name	*Status	Habitat	Potential For Occurrence In The Planning Area
Caper-fruited tropidocarpum (*Tropidocarpum capparideum*)	CNPS 1B.1	Valley and foothill grassland (alkaline hills). Elevation 3-1476 feet.	**Absent.** Ruderal grassland could provide marginal habitat. However, this species has never been found in San Mateo County and is presumed extirpated from San Francisco Bay Area (CNPS 2013).

Appendix B. Detailed Descriptions of Special-status Wildlife Species Potentially Occurring in the Planning Area

Federal or State Endangered and Threatened Species

Green Sturgeon (*Acipenser medirostris*). Federal Listing Status: Threatened; State Listing Status: Species of Special Concern. The NMFS listed the southern Distinct Population Segment (DPS) of the green sturgeon as threatened on 7 April 2006 (NMFS 2006a). Critical habitat for the southern DPS of the green sturgeon was designated on 9 October 2009 (NMFS 2009). All tidally influenced areas of the San Francisco Bay, up to the elevation of mean higher high water, including San Francisquito Creek upstream to 37°27'10" North 122°7'40" West, have been designated as critical habitat for this species (NMFS 2009).

The range of the green sturgeon extends from Ensenada, Mexico, to the Bering Sea; the species occurs in coastal waters from the San Francisco Bay to Canada. Green sturgeon occur widely in accessible estuarine habitat, and in summer and fall the species is found in estuaries not associated with known spawning activity and where there are no records of their occurrence farther up the river system (Adams et al. 2007). Spawning within the southern DPS occurs predominantly in the upper Sacramento River (Adams et al. 2007).

Green sturgeon juveniles are found throughout the Sacramento/San Joaquin River delta and San Francisco Bay (Beamesderfer et al. 2007, Kelly et al. 2007). Although little is known about the distribution and abundance of green sturgeon in the South Bay, the species appears to be relatively rare. The CDFW conducts monthly monitoring of fish assemblages at numerous sites in the San Francisco, San Pablo, and Suisun bays using otter trawls and midwater trawls, of which 13 sites are in the South Bay. Between 1980 and 2011, 74 green sturgeon were captured in the San Francisco Estuary; however, only four of these were collected in the South Bay, two at a main channel site near the Bay Bridge and two from a shoal site north of the San Mateo Bridge (K. Hieb, CDFW, pers. comm.). According to NMFS (2009), a sport fishing group reported catches of two green sturgeon in Central San Francisco Bay, three in South-Central San Francisco Bay, and four in South San Francisco Bay in 2006. To date, the only confirmed record of green sturgeon south of the Dumbarton Bridge is represented by a single individual that had been equipped with an acoustic tag in the Sacramento River or Delta and that was detected on multiple occasions in 2011 at receivers positioned along the Dumbarton Railroad Bridge (ECORP 2012). Receivers had also been placed in the main channel of Coyote Slough, at the confluence of Coyote and Alviso Sloughs, and in recently breached salt ponds in the Alviso area (Ponds A19 and A21 at the Island Ponds and Pond A6), but no green sturgeon were detected in those areas.

Green sturgeon likely occur only irregularly and in low numbers in the planning area because of the species very limited abundance in the vicinity. Further, green sturgeon are not expected to spawn in the planning area due to the relatively shallow depth of San Francisquito Creek and its lack of deep freshwater pools.

Longfin Smelt (*Spirinchus thaleichthys*). Federal Listing Status: Proposed Endangered Status; State Listing Status: Threatened. This southernmost population of longfin smelt is found as far north as Prince William Sound, Alaska, and occurs in the San Francisco Bay. The longfin smelt was declared a threatened species under the CESA in March 2009 and has been petitioned for listing as endangered under the FESA (USFWS 2008a).

Longfin smelt are adapted to a wide range of salinities and occupy different portions of the Bay throughout the year. The majority of adults are found in the Central Bay, San Pablo Bay, and Suisun Bay in the summer but move upstream in early fall. Adults are most widespread in the winter and spring, when there distribution extends from the South Bay through the Delta, with the greatest concentrations in San Pablo Bay, Suisun Bay, and the West Delta (Rosenfield 2009). Spawning in the Bay is thought to occur mainly below Medford Island in the San Joaquin River and below Rio Vista on the Sacramento River, while the lower end of spawning habitat seems to be upper Suisun Bay around Pittsburg and Montezuma Slough, in Suisun Marsh (Larson et al. 1983 as cited in Moyle 2002, Wang 1986).

Distribution of larvae is strongly influenced by freshwater outflow to the Delta (Baxter 1999 and Dege and Brown 2004 as cited in Robinson and Greenfield 2011). In dry years, larvae are concentrated primarily in the West Delta and Suisun Bay, and in wet years, larvae are found throughout the San Francisco Estuary, including the South Bay, with the greatest concentrations in San Pablo and Suisun Bay early in the season and into the Central Bay later in the season (Rosenfield 2009). Juveniles occupy the entire upper estuary through the Central Bay during their first summer, moving throughout the estuary by the following winter (CDFG 2009).

In the South Bay, individuals have been collected in the Alviso area and in Alviso Slough (EDAW Inc. 2007), but fish sampling in Coyote Slough and the Island Ponds has detected the species only in January and March, suggesting that the species may be absent from the South Bay during the summer (Hobbs et al. 2012). In the planning area, longfin smelt may be present in the salt marsh sloughs and open waters of the Bay year-round. However, because spawning has not been confirmed in the South Bay, and due to the low habitat quality provided by San Francisquito Creek (due to channelization), the species is not expected to spawn in the planning area.

Central California Coast Steelhead (*Oncorhynchus mykiss*). Federal Listing Status: Threatened; State Listing Status: None. The NMFS has categorized steelhead into DPS. The Central California Coast DPS consists of all runs from the Russian River in Sonoma County south to Aptos Creek in Santa Cruz County, including all steelhead spawning in streams that flow into the San Francisco Bay. In 1997, the NMFS published a final rule to list the Central California Coast DPS as threatened under the FESA (NMFS 1997). Critical habitat for this DPS was designated on 2 September 2005 (NMFS 2005). Designated critical habitat for Central California Coast steelhead includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays (NMFS 2000, 2005). Thus, the sloughs within the salt marsh habitat in the planning area and the tidally influenced portion of San Francisquito Creek are within designated critical habitat.

The steelhead is an anadromous form of rainbow trout that migrates upstream from the ocean to spawn in late fall or early winter, when flows are sufficient to allow them to reach suitable habitat in far upstream areas. In the South Bay, adults typically migrate to spawning areas from late December through early April, and both adults and smolts migrate downstream from February through May. Steelhead typically spawn in gravel substrates located in clear, cool, perennial sections of relatively undisturbed streams, with dense canopy cover that provides shade, woody debris, and organic matter. Steelhead usually cannot survive long in pools or streams with water temperatures above 70 °F, however, they can use warmer habitats if adequate food is available.

San Francisquito Creek contains one of the few remaining steelhead runs in the South Bay (Leidy et al. 2005, Stanford University 2013), supporting an anadromous run of steelhead up to Searsville Dam. Although suitable spawning habitat is not present within the planning area, steelhead occur in San Francisquito Creek during upstream migration of adults (January – April) to spawning habitat in upper San Francisquito Creek, Los Trancos Creek, West Union Creek, and Bear Creek (Leidy et al. 2005), and downstream migration of both adults and smolts (February – May, but peaking in February-April) heading toward the ocean. However, steelhead outmigration success is limited by seasonal drying of the channel. The mouth of San Francisquito Creek, located between Highway 101 and San Francisco Bay, is tidally influenced and contains Bay water even during the summer months. However, San Francisquito Creek upstream of Highway 101 to Sand Hill Road in Palo Alto is typically dry during the summer months (City of Palo Alto 2006). In years when flows of sufficient magnitude, duration, or timing fail to occur, outmigrating smolts are subject to mortality caused by desiccation, predation, elevated water temperatures, and other factors (Jones & Stokes 2006).

Juvenile steelhead may also use tidal channels in the salt marsh habitat in the planning area during the process of smoltification (i.e., physiological adaptation to the saltwater environment) as they move from freshwater to the ocean, and the vegetated edges of sloughs may provide foraging habitat and protection from predators and water currents, but there is virtually no information regarding the extent or duration of their use of this area.

Western Snowy Plover (*Charadrius alexandrinus nivosus*). Federal Listing Status: Threatened; State Listing Status: Species of Special Concern. The snowy plover is a small shorebird that occurs on almost every continent. On the Pacific coast, snowy plovers nest on sandy beaches and salt panne habitat from Washington to Baja Mexico. Because they nest during the summer, primarily on beaches in a temperate climate, snowy plovers are susceptible to nest disturbance and other negative interactions with humans. Much of their nesting habitat, particularly in southern California, has been lost to development and high human use. In addition, introduced predators, especially the non-native red fox, have had dramatic effects on snowy plover nesting success (Neuman et al. 2004). In response to severe population declines, the USFWS listed the Pacific coast population of the western snowy plover as threatened in 1993. Critical habitat was designated for this population in 1999 (USFWS 1999) and revised in 2012 (USFWS 2012). A revised recovery plan was released in 2007 (USFWS 2007). Critical habitat is not present in the planning area, but the Ravenswood (CA 14) critical habitat unit is located along the shoreline just north of the planning area.

In the South San Francisco Bay, snowy plovers nest on low, barren to sparsely vegetated saline managed pond levees and islands, at pond edges, and on salt panne areas of dry ponds (Page et al. 2000), and preferentially use light-colored substrates such as salt flats (Feeney and Maffei 1991, Marriott 2003). Nesting areas are located near water, where prey (usually brine flies and other insects) are abundant. In some areas, snowy plovers nest within dry saline managed ponds; in other areas where ponds typically hold water through the summer, nests are located primarily on levees.

Near the planning area, western snowy plovers nest in the Ravenswood Complex of the Don Edwards San Francisco Bay Wildlife Refuge (72 nests were recorded in 2010 [Robinson-Nilsen et al. 2010]), including the managed pond just north of the planning area. However, suitable nesting habitat is not present in the planning area due to the absence of islands and undisturbed levees within the salt marsh. Although this species forages infrequently on tidal mudflats, small numbers of individuals from the nearby breeding areas may occasionally forage on the mudflats in the planning area.

California Least Tern (*Sterna antillarum brownii*). Federal Listing Status: Endangered; State Listing Status: Endangered, Fully Protected. California least terns nest in California during the breeding season from April to September (Rigney and Granholm 1990, Baron and Takegawa 1994). Their nesting habitat consists of shallow depressions in sand or small gravel along large tracts of undisturbed beaches (Baron and Takegawa 1994, Marschalek 2008). The loss of available high quality nesting habitat for least terns resulted in a reduction in population size to only 600 known breeding pairs (Baron and Takegawa 1994). In response to severe population declines, the USFWS listed the California least tern as endangered in 1970 (USFWS 1970), and the State of California listed the species as both endangered and fully protected in 1971 (Baron and Takegawa 1994). No critical habitat has been designated for this species.

Habitat requirements for the California least tern typically consist of quiet, extensive beaches or tidal flats located close to an abundance of small fish (Baron and Takegawa 1994, Rigney and Granholm 1990). In San Francisco Bay, this species' largest colony is located on an old airport runway at the former Alameda Naval Air Station, although small numbers of least terns nest on islands and salt pannes in former saline managed ponds in a few areas.

Least terns nest in small colonies and, due to their endangered status, nesting locations are closely monitored and well known. In recent decades, the closest least terns have nested to the planning area is in the Eden Landing Ecological Preserve, just south of Highway 92 in Fremont, Alameda County. California least terns are, therefore, not expected to nest in the planning area.

However, the South Bay is an important post-breeding staging area for least terns to gather before migration, and this species forages in late summer and early fall in saline managed ponds and on the Bay from Mountain View through Sunnyvale. Both adult and juvenile least terns roost on saline managed pond levees (both outboard levees and interior levees between ponds) and boardwalks, and forage both in the saline managed ponds and over the open waters of the Bay. In recent years, the post-breeding (late summer/fall) staging area for least terns in the South Bay has been in the complex of saline-managed ponds immediately north of Moffett Field (Ponds AB1, A2E, and AB2). This site is used predictably for roosting and foraging by both adult and juvenile least terns in July and August each year, with typical counts of 20 to 100 birds. Least terns also have been recorded at the Palo Alto Baylands adjacent to the planning area (eBird 2013), and small numbers may forage over open water habitat in the planning area.

California Clapper Rail (*Rallus longirostris obsoletus*). Federal Listing Status: Endangered; State Listing Status: Endangered and Fully Protected. The California clapper rail is a secretive marsh bird that is currently endemic to marshes of the San Francisco Bay. It formerly nested at several other locations, including Humboldt Bay (Humboldt County), Elkhorn Slough (Monterey County), and Morro Bay (San Luis Obispo County), but is now extirpated from all sites outside of the San Francisco Bay (Harding-Smith 1993). California clapper rails nest in salt and brackish marshes along the edge of the Bay, and are most abundant in extensive salt marshes and brackish marshes dominated by Pacific cordgrass, pickleweed, and marsh gumplant and that contain complex networks of tidal channels (Harvey 1980). Shrubby areas adjacent to or within these marshes are also important for predator avoidance at high tides.

Since the mid-1800s, about 90 percent of the San Francisco Bay's marshlands have been eliminated through filling, diking, or conversion to salt evaporation ponds (Goals Project 1999). As a result, the California clapper rail lost most of its former habitat, and its population declined severely. The subspecies was listed as endangered by the USFWS in 1970 (USFWS 1970) and by the State of California in 1971. The USFWS approved a joint recovery plan for the salt marsh harvest mouse and the California clapper rail in 1984 (USFWS 1984), and an updated Tidal Marsh Species Recovery Plan is currently under development. Critical habitat has not been proposed for the California clapper rail.

Clapper rails are typically found in the intertidal zone and sloughs of salt and brackish marshes dominated by pickleweed, Pacific cordgrass, gumplant, saltgrass, jaumea, and adjacent upland refugia. They may also occupy habitats with other vegetative components, which include, but are not limited to, bulrush, cattails, and Baltic rush. Shrubby areas adjacent to or within these marshes are also important for predator avoidance at high tides. The species does not occur in muted tidal or diked salt marshes. However, they have been documented in brackish marshes in the South Bay. Surveys conducted during the 1990 breeding season (H. T. Harvey & Associates 1990b) and winter season (H. T. Harvey & Associates 1990a) found a number of California clapper rails occupying salt/brackish transitional marshes and several brackish, alkali bulrush-dominated marshes. In addition, California clapper rails were found in nearly pure stands of alkali bulrush along Guadalupe Slough in 1990 and 1991 (H. T. Harvey & Associates 1990a, 1990b, 1991). Occasional non-breeding individuals may also wander upstream along tidal sloughs from their typical salt marsh habitats into tidal brackish/freshwater marsh habitats.

The salt marshes in the planning area provides suitable nesting and foraging habitat for the California clapper rail, and numerous detections of this species have been recorded both within and immediately adjacent to the planning area (Olofson Environmental, Inc. 2011, PRBO Conservation Science 2011, CNDDB 2013).

California Black Rail (*Laterallus jamaicensis coturniculus*). Federal Listing Status: None; State Listing Status: Threatened and Fully Protected. The California black rail is a small rail that inhabits a variety of marsh types. California black rails are most abundant in extensive tidal marshes with some freshwater input (Evens et al. 1991). They nest primarily in pickleweed-dominated marshes with patches or borders of bulrushes, often near the mouths of creeks. Black rails build nests in tall grasses or marsh vegetation during spring, and lay about six eggs. Nests are usually constructed of pickleweed, and are placed directly on the ground or slightly above ground in vegetation. Black rails feed on terrestrial insects, aquatic invertebrates, and possibly seeds (Trulio and Evens 2000). The California black rail was listed under the CESA in 1971 and is fully protected species under state Fish and Game Code.

The California black rail reportedly nested in the Alviso area in the early 1900s (Wheelock 1916), but until recently it was known in the South Bay primarily as a non-breeder. Black rails were detected in Triangle Marsh east of the planning area in 2012. Fourteen of these rails were tracked throughout the 2012 nesting season in Triangle Marsh, suggesting that the species nests there (Laurie Hall, pers. comm.). During the spring and early summer of 2013, small numbers of black rails were detected calling along lower and mid-Alviso Slough (http://groups.yahoo.com/group/south-bay-birds). These records suggest that small numbers of black rails have recently begun oversummering, and likely breeding, in the South Bay. However, black rails nest primarily in marshes in northern San Francisco Bay (i.e., San Pablo Bay and Suisun Bay), and this species is expected to occur in most parts of the South Bay primarily as a scarce winter visitor.

The scarcity of nesting black rails in the South Bay is presumably a result of habitat loss. Tidal marsh habitat has been lost, but perhaps more important to winter survival is the loss of high-tide refugia. Upland transition habitat, both on natural levees within marshes and on landward edges of marshes, has been lost as a result of fill for development, and reductions in marsh size and resulting reductions in natural levees along higher-order channels. Predation of black rails by egrets, herons, gulls, and harriers has been observed in these marshes during winter high tides, as rails are forced into the open by rising water. The importance of this predation on a population level, especially in light of impacts on high tide refugia, is unknown, but it may be a significant factor in the extirpation of nesting populations of the species from the South Bay.

Near the planning area, California black rails have been recorded during winter in the Ravenswood Open Space Preserve just to the north and on the Palo Alto Baylands to the south (eBird 2013), and the salt marsh habitat within the planning area provides suitable nonbreeding habitat. These tidal marshes could be used for foraging by black rails that disperse into the area after the nesting season, but they are not expected to be used for nesting, because this species has not been recorded nesting in the vicinity.

Bald Eagle (*Haliaeetus leucocephalus*). Federal Listing Status: None; State Listing Status: Endangered, Fully Protected. Bald eagle populations exhibited precipitous declines in the early part of the twentieth century, primarily as a result of pesticide poisoning that severely affected reproductive rates. DDT was the most debilitating of these chemicals, and ever since its use was banned in the United States in 1972, eagle populations have recovered rapidly (Buehler 2000). The bald eagle was removed from the federal endangered species list in 2008 (USFWS 2008b) but remains listed as both endangered and fully protected by California (CDFG 2008b).

Currently, bald eagles are found throughout North America, along waterways and coasts (Buehler 2000). In California, bald eagle populations remain low, although their numbers are increasing steadily (Peeters and Peeters 2005). Bald eagles can be found nesting in a number of locations in the Sierra Nevada range and southern California, and they nest in a few scattered locations in central California as well (Buehler 2000, CDFG 2008b). Ideal habitat for bald eagles is comprised of remote, forested landscape with old-growth or mature trees and easy access to an extensive and diverse prey base. Bald eagles forage in fresh and salt water where their prey species (fish) are abundant and diverse. They build nests in tall, sturdy trees at sites that are in relatively close proximity to aquatic foraging areas and isolated from human activities. The eagle breeding season extends from January through August (Buehler 2000).

The bald eagle been recorded nesting in the region only at and near inland reservoirs. This species is very rare along the Bay edge, but it has been observed at the Palo Alto Baylands just south of the planning area (eBird 2013). The species may be present in the planning area as an occasional forager in aquatic habitats adjacent to the Bay.

Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*). Federal Listing Status: Endangered; State Listing Status: Endangered and Fully Protected. The salt marsh harvest mouse is a rodent endemic to the salt and brackish marshes, and adjacent tidally influenced areas, of the San Francisco Bay estuary. At present, the distribution of the northern subspecies, *R. raviventris halicoetes*, occurs along Suisun and San Pablo Bays north of Point Pinole in Contra Costa County, and Point Pedro in Marin County. The southern subspecies, *R. raviventris raviventris*, is found in marshes in Corte Madera, Richmond, and South Bay mostly south of the San Mateo Bridge (Highway 92).

The salt marsh harvest mouse has evolved to a life in tidal marshes. The species depends mainly on dense pickleweed as its primary cover and food source and may utilize a broader source of food and cover that includes saltgrass (*Distichlis spicata*) and other vegetation typically found in the salt and brackish marshes of this region. In natural systems, salt marsh harvest mice can be found in the middle tidal marsh and upland transition zones. Upland refugia are an essential habitat component during high tide events, when the marsh plain is inundated, as salt marsh harvest mice are highly dependent on cover (Shellhammer 1978, as cited in USFWS 1984). The harvest mouse does not burrow, but the northern subspecies may build nests of loose grasses. Salt marsh harvest mice are capable of breeding year-round, although most reproductive activity likely occurs between March and November, with a peak in mid-summer.

Cover-dependent salt marsh harvest mice are unlikely to move long distances over bare areas, and thus, isolation of suitable habitat may lead to genetic isolation of populations or local extinctions. While they are known to swim well, especially in comparison with western harvest mice, they have not been documented to move more than 13.1 to 16.4 feet across water or more than 16.4 feet over bare ground (Bias 1994, Geissel et al. 1988). The maximum movement through brackish or fresh water vegetation is reported by H. T. Harvey & Associates (Shellhammer 1982), in which two harvest mice moved several hundred feet along a levee side-slope at the upper edge of a brackish marsh. Based on this information, Shellhammer and Duke (2004) have hypothesized that barren areas of land more than 16.4 feet wide, reaches of water more than 42 feet wide, and brackish or freshwater marsh more than 820 feet wide act as barriers to movement of the southern subspecies of the harvest mouse, and hence barriers to gene flow. Areas of bare ground, water, or fresh/brackish marsh less than or equal to these distances may act as filters, reducing the movement of this species (and hence the rate of gene flow) between populations or between portions of a semi-fragmented population. The isolation of populations has contributed to the decline of the species (Shellhammer and Duke 2004) and could lead to local extinctions due to demographic processes or genetic "death."

Salt marsh harvest mouse populations have declined substantially in recent decades due to habitat loss, degradation, and fragmentation, and as a result harvest mouse populations are very low. The loss of habitat for salt marsh harvest mice is due primarily to the diking and filling of marshes, subsidence, and changes in salinity brought about by increasing volumes of fresh water discharge into the Bay. In response to habitat loss and fragmentation and corresponding population declines, the salt marsh harvest mouse was listed as endangered by the USFWS in 1970 (USFWS 1970) and by the State of California in 1971. Critical habitat has not been designated for this species. A *Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* was issued in 2010 (USFWS 2010) that is an expansion and revision of the *Salt Marsh Harvest Mouse and California Clapper Rail Recovery Plan* issued in 1984 (USFWS 1984).

Suitable salt marsh habitat is present in the planning area and numerous detections of this species have been recorded in salt marsh habitat both within and immediately adjacent to the planning area (H. T. Harvey & Associates 1991, H. T. Harvey & Associates 2009, CNDDB 2013).

California Species of Special Concern

Central Valley Fall-run Chinook Salmon (*Oncorhynchus tshawytscha*). Federal Listing Status: None; State Listing Status: Species of Special Concern. Like the steelhead, the Chinook salmon is an anadromous salmonid. Populations of Pacific salmon have been categorized into Evolutionarily Significant Units (ESUs) by the NMFS; an ESU represents a population of Pacific salmon that is reproductively isolated from other conspecific populations, and is recognized as a distinct evolutionary component of the species. The Central Valley Fall-run ESU represents a population of Chinook salmon that migrate from the ocean to spawning streams in late fall and begin spawning in beds of coarse river gravels between October and December. Populations of fall-run Chinook salmon have suffered the effects of over-fishing by commercial fisheries, degradation of spawning and rearing habitat, added barriers to upstream migration, and reductions in winter flows due to damming. Approximately 40 to 50 percent of spawning and rearing habitats in Central

Valley streams have been lost or degraded. Chinook salmon generally spawn in cool waters providing incubation temperatures no warmer than 55 °F. Compared to steelhead, Chinook salmon are more likely to spawn in coarse gravels located lower in the watershed.

Chinook salmon did not historically spawn in streams flowing into South San Francisco Bay. However, small numbers of fall-run Chinook salmon have been found in several such streams within the region since the mid-1980s including Coyote Creek, Los Gatos Creek, and the Guadalupe River (Leidy et al. 2003). Genetic analysis, timing of spawning, and the detection of coded wire-tagged hatchery fish in the Project region suggests that these fish are derived from Central Valley fall-run stock (Garcia-Rossi and Hedgecock 2002), possibly hatchery releases, and do not represent a native run.

Chinook salmon have not been documented in San Francisquito Creek. It is possible that occasional strays from Central Valley streams may occur in San Francisquito Creek as they do in other South Bay creeks, but they are expected to occur in the planning area irregularly at best and most likely would occur only in the open waters of the Bay.

Western Pond Turtle (*Actinemys marmorata*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The western pond turtle occurs in ponds, streams, and other wetland habitats in the Pacific slope drainages of California and northern Baja California, Mexico (Bury and Germano 2008). The central California population was historically present in most drainages on the Pacific slope (Jennings and Hayes 1994), but streambed alterations and other sources of habitat destruction, exacerbated by frequent drought events, have caused substantial population declines throughout most of the species' range (Stebbins 2003). Ponds or slack-water pools with suitable basking sites (such as logs) are an important habitat component for this species, and western pond turtles do not occur commonly along high-gradient streams. Females lay eggs in upland habitats, in clay or silty soils in unshaded (often south-facing) areas up to 0.25 mile from aquatic habitat (Jennings and Hayes 1994). Juveniles feed and grow in shallow aquatic habitats (often creeks) with emergent vegetation and ample invertebrate prey. Nesting habitat is typically found within 600 feet of aquatic habitat (Jennings and Hayes 1994), but if no suitable nesting habitat can be found close by adults may travel overland considerable distances to nest. Threats to the western pond turtle include impacts on nesting habitat from agricultural and grazing activities, human development of habitat, and increased predation pressure from native and non-native predators as a result of human-induced landscape changes.

San Francisquito Creek and freshwater marshes within the planning area provide suitable habitat for the western pond turtle, which has been documented within San Francisquito Creek approximately 1 mile upstream of the planning area (CNDDB 2013). Consequently, it is likely that small numbers of western pond turtles occur in the planning area. However, the cumulative stressors of urbanization including the release of non-native turtles, predation and harassment by pets and non-native mammals, capture by humans, degradation of water quality, loss of upland nesting habitat due to development, and the construction of barriers between creeks and nesting areas have reduced western pond turtle populations, and pond turtle numbers are expected to be low in the planning area. It is possible that pond turtles nest along levees in the planning area, albeit in low numbers.

Northern Harrier (*Circus cyaneus*). Federal Listing Status: None; State Listing Status: Species of Special Concern (Nesting). The northern harrier nests in marshes and grasslands with tall vegetation and sufficient moisture to inhibit accessibility of nest sites to predators. This species forages primarily on small mammals and birds in a variety of open grassland, ruderal, and agricultural habitats.

Northern harriers forage in a variety of open habitats, especially during the nonbreeding season. The species is fairly widespread as a forager in grasslands and extensive wetlands in the region during migration and winter and is expected to occur as a forager in the planning area. In addition, northern harriers nest in small numbers in more extensive patches of tidal marsh habitat close to San Francisco Bay, likely including marshes within the planning area. Thus, one to two pairs are expected to nest within the planning area. Nonbreeders may also forage in grassland habitats in the planning area, but are not expected to forage in more densely developed/urbanized areas.

Burrowing Owl (*Athene cunicularia*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The burrowing owl is a small, terrestrial owl of open country. These owls prefer annual and perennial grasslands, typically with sparse or nonexistent tree or shrub canopies. In California, burrowing owls are found in close association with California ground squirrels; owls use the abandoned burrows of ground squirrels for shelter and nesting. The nesting season as recognized by the CDFW (CDFG 1995) runs from 1 February through 31 August. After nesting is completed, adult owls may remain in their nesting burrows or in nearby burrows, or they may migrate (Rosenberg et al. 2007); young birds disperse across the landscape from 0.1 to 35 miles from their natal burrows (Rosier et al. 2006). Burrowing owl populations have declined substantially in the San Francisco Bay area in recent years, with declines estimated at 4-6 percent annually (DeSante et al. in press, in Rosenberg et al. 2007).

Burrowing owls are not expected to nest in the planning area due to the absence of high quality habitat and the lack of recent breeding records in the vicinity. However, small numbers may occasionally occur in grasslands and ruderal habitats in the planning area during dispersal from breeding sites to the north and south (such as Bayfront Park in Menlo Park and Shoreline Park in Mountain View) or as migrants.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Listing Status: None; State Listing Status: Species of Special Concern (Nesting). The loggerhead shrike is a predatory songbird associated with open habitats interspersed with shrubs, trees, poles, fences, or other perches from which it can hunt (Yosef 1996). Nests are built in densely foliated shrubs or trees, often containing thorns, which offer protection from predators and upon which prey items are impaled. The breeding season for loggerhead shrikes may begin as early as mid-February and lasts through July (Yosef 1996). Nationwide, loggerhead shrike populations have declined significantly over the last 20 years. Loggerhead shrikes are still fairly common in parts of the Bay area, but urbanization has reduced available habitat, and local populations are likely declining (Cade and

Woods 1997, Humple 2008). Loss and degradation of breeding habitat, as well as possible negative impacts of pesticides, are considered the major contributors to the population declines exhibited by this species (Cade and Woods 1997, Humple 2008).

Grassland/ruderal and marsh habitats in the planning area provide suitable nesting, roosting, and foraging habitat for one or two pairs of loggerhead shrikes. This species may occur slightly more widely (i.e., in smaller patches of open areas providing foraging habitat) during the nonbreeding season.

San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The San Francisco common yellowthroat inhabits emergent vegetation and nests in fresh and brackish marshes and moist floodplain vegetation around the San Francisco Bay. Common yellowthroats will use small and isolated patches of habitat as long as groundwater is close enough to the surface to encourage the establishment of dense stands of rushes (*Scirpus* and *Juncus* spp.), cattails, willows, and other emergent vegetation (Nur et al. 1997, Gardali and Evens 2008). Ideal habitat, however, is comprised of extensive, thick riparian, marsh, or herbaceous floodplain vegetation in perpetually moist areas, where populations of brown-headed cowbirds are low (Menges 1998). San Francisco common yellowthroats nest primarily in fresh and brackish marshes, although they nest in salt marsh habitats that support tall vegetation (Guzy and Ritchison 1999). This subspecies builds open-cup nests low in the vegetation, and nests from mid-March through late July (Guzy and Ritchison 1999, Gardali and Evens 2008).

The San Francisco common yellowthroat is one of approximately 12 subspecies of common yellowthroat recognized in North America, two of which occur in the Project region. Because subspecies cannot be reliably distinguished in the field, determination of the presence of San Francisco common yellowthroat can be achieved only by locating birds that are actively nesting within the breeding range known for the subspecies. Common yellowthroats nesting in the planning area are of the special-status *sinuosa* subspecies (San Francisco Bay Bird Observatory 2012).

In the South Bay, the San Francisco common yellowthroat is a fairly common breeder in fresh and brackish marshes. It is known to nest near the edge of the South Bay, as well as in herbaceous riparian habitat and ruderal floodplain habitat along streams entering the Bay. Tall vegetation within the salt, brackish, and freshwater marsh habitat within the planning area provides suitable breeding and foraging habitat for this species.

Alameda Song Sparrow (*Melospiza melodia pusillula*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The Alameda song sparrow is one of three subspecies of song sparrows that nest only in salt marsh habitats in the San Francisco Bay area (Chan and Spautz 2008). Prime habitat for Alameda song sparrows consists of large areas of tidally influenced salt marsh dominated by cordgrass and gumplant and intersected by tidal sloughs, offering dense vegetative cover and singing perches. Although the special-status pusillula subspecies (the "species" of special concern) is occasionally found in brackish marshes dominated by bulrushes, it is apparently very sedentary and is not known to disperse upstream into freshwater habitats (Basham and Mewaldt 1987). While the range of the Alameda song sparrow has remained relatively unchanged over time, populations have been reduced substantially and are continually threatened by the loss and fragmentation of salt marshes around the Bay (Nur et al. 1997, Chan and Spautz 2008).

Song sparrows nest as early as March, but peak nesting activity probably occurs in May and June. Song sparrows that nest in salt marshes in the Bay area (including *pusillula*) are known to nest about two weeks earlier than the more widespread *gouldii* subspecies, which nests farther inland in freshwater habitats (Johnston 1954; Johnston 1956). This early nesting by *pusillula* is apparently an adaptation to breeding in a tidal environment, as high tides in late spring and early summer may destroy large numbers of nests.

The salt and brackish marsh habitat within the planning area provides suitable breeding and foraging habitat for the Alameda song sparrow, and it is a common breeder in these marshes.

Bryant's Savannah Sparrow (*Passerculus sandwichensis alaudinus*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The Bryant's savannah sparrow is one of four subspecies of savannah sparrows that nest in California. The *alaudinus* subspecies occurs primarily along coastal and bay shore areas from Humboldt Bay to Morro Bay, and is found year-round in low-elevation tidally influenced habitat. Specifically, this subspecies prefers pickleweed-dominated salt marshes, although it also occurs in adjacent grasslands and ruderal areas. In the South Bay, levee tops with short vegetative growth and levee banks with high pickleweed are the preferred nesting habitat of this subspecies (Fitton 2008).

Bryant's savannah sparrows nest in the South Bay primarily in short pickleweed-dominated portions of diked/muted tidal salt marsh habitat, and in adjacent ruderal habitat. The high marsh habitat within the planning area provides suitable breeding and foraging habitat for this species.

Salt Marsh Wandering Shrew (*Sorex vagrans halicoetes*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The salt marsh wandering shrew was historically more widely distributed in the San Francisco Bay, but it is currently confined to salt marshes in the South Bay (Findley 1955). Salt marsh wandering shrews occur most often in medium to high wet tidal marsh (6 to 8 feet above sea level), with abundant driftwood and other debris for cover (Shellhammer 2000). Typically, they are found in fairly tall pickleweed, in which they build nests. This species has also been recorded in diked marsh habitat. Salt marsh wandering shrews are occasionally captured during salt marsh harvest mouse trapping studies, but the difficulty in identifying them to species has precluded a better understanding of their current distribution in the South Bay. The shrew was formerly recorded from marshes of San Pablo and San Francisco Bays in Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties, but captures in recent decades have been very infrequent in these areas.

Although this species' distribution and habitat associations in the South Bay are not well known, pickleweed-dominated salt marsh habitat is present in the planning area. Thus, this species is expected to breed in the salt marsh habitat within the planning area.

Western Red Bat (*Lasiurus blossevillii*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The western red bat is a locally common bat in coastal California and the Central Valley, and its range extends from Shasta County to Baja California, Mexico (Zeiner et al. 1990b). Western red bats are strongly associated with intact cottonwood and sycamore valley riparian habitats in low elevations (Pierson et al. 2006), and the loss of such habitats throughout the species' range threatens the persistence of the western red bat (Western Bat Working Group 2005). Both day and night roosts are usually located in the foliage of trees; red bats in the Central Valley show a preference for large trees and extensive, intact riparian habitat (Pierson et al. 2006). Day roosts are often located along the edges of riparian areas, near streams, grasslands, and even urban areas (Western Bat Working Group 2005). During the breeding season, red bats establish individual tree roosts and occasionally small maternity colonies in riparian habitats (Zeiner et al. 1990b). Little is known about the habitat use of western red bats during the nonbreeding season (Pierson et al. 2006). The red bat uses echolocation to capture insects in mid-flight, and requires habitat mosaics or edges that provide close access to foraging sites as well as cover for roosting (Zeiner et al. 1990b).

The Central Valley is assumed to be the primary breeding location of western red bat populations in California, and red bats likely occur in the San Francisco Bay area only during winter and migration (Pierson et al. 2006). Western red bats are expected to be regular migrants and winter residents within the planning area, but they are not known or expected to breed here. Individual male and female bats may occur as occasional migrants during the fall and spring or as foragers during the winter, and nonbreeding individual males may occur during the summer. No breeding females occur in the planning area during the summer. Small numbers of western red bats may roost in the foliage in trees virtually anywhere throughout the Planning Area, but they are expected to roost primarily in wooded riparian areas along San Francisquito Creek.

San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*). Federal Listing Status: None; State Listing Status: Species of Special Concern. The San Francisco dusky-footed woodrat occurs in a variety of woodland and scrub habitats throughout the South Bay and the adjacent central coast range, south to the Pajaro River in Monterey County (Hall 1981, Zeiner et al. 1990b). Woodrats prefer riparian and oak woodland forests with dense understory cover, or thick chaparral habitat (Lee and Tietje 2005). Although woodrats are locally common in many areas, habitat conversion and increased urbanization, as well as increasing populations of introduced predators, such as domestic cats, pose substantial threats to this subspecies (H. T. Harvey & Associates 2008). Dusky-footed woodrats build large, complex nests of sticks and other woody debris, which may be maintained by a series of occupants for several years (Carraway and Verts 1991). Woodrats are also very adept at making use of human-made structures, and can nest in electrical boxes, pipes, wooden pallets, and even portable storage containers. Woodrat nest densities increase with canopy density and with the presence of poison oak (Carraway and Verts 1991). While the San Francisco dusky-footed woodrat is described as a generalist omnivore, individuals may specialize on local plants that are available for forage (Haynie et al. 2007). The breeding season for dusky-footed woodrats begins in February and sometimes continues through September, with females bearing a single brood of one to four young per year (Carraway and Verts 1991).

Suitable habitat for the dusky-footed woodrat in the mostly-urban planning area is limited to the riparian woodlands adjacent to San Francisquito Creek upstream of the Highway 101 overcrossing. However, this species is likely present in very low densities, if it is present at all, due to the long history of urbanization, which has reduced dispersal and subjected this species to predation by housecats and urban-adapted predators.

State Fully Protected Species

California Brown Pelican (*Pelecanus occidentalis californicus*). Federal Listing Status: Delisted; State Listing Status: Delisted, Fully Protected. California brown pelican populations were decimated by the effects of the pesticide DDT, resulting in the species being listed as endangered both under the FESA and CESA. While the species began to recover after the chemical was banned in 1972, the California population continued to be threatened by other environmental contaminants, habitat loss, and human disturbance, to which this species is extremely sensitive (Jacques et al. 1996, Shields 2002). A recovery plan that laid out recovery goals was developed for the species in 1983 (USFWS 1983). In 2009, the California brown pelican population was determined to have sufficiently recovered as indicated by the increase in the breeding population size, expansion of nesting sites, increased productivity, and increased recruitment to the population to be delisted by both the federal (USFWS 2009) and state agencies (California Fish and Game Commission 2009).

The California brown pelican ranges along the west coast of North America, being most common from the San Francisco Bay Area south to Baja California but occasionally dispersing in numbers north into Oregon and Washington. Established nesting colonies occur along the coast from the Channel Islands in California south through Baja California and inland at the Salton Sea; many individuals disperse northward after nesting, and communal nonbreeding roosts occur throughout the species' range (Shields 2002). Pelicans are highly gregarious in all seasons, often forming large communal nonbreeding roosts from which they range miles to forage (Shields 2002). Preferred nonbreeding roost sites are comprised of estuaries, sand bars, spits, or beaches that are close to aquatic foraging grounds, allow the birds to dry off after foraging, and offer shelter from predators and the elements (Jacques et al. 1996, Shields 2002). Sites that are completely or almost completely surrounded by water are required for night roosts, to maximize protection from predators (Jacques et al. 1996). Pelicans forage in relatively warm brackish and ocean waters where fish are close enough to the surface to be captured by plunge-diving birds (Shields 2002).

Brown pelicans occur in the Bay area only as nonbreeding visitors. Although a small number of nonbreeding birds may be found locally year-round, most brown pelicans return to their southern nesting grounds by

January. They are found foraging in San Francisco Bay and in managed ponds containing fish at the edges of the Bay. Managed ponds generally provide suitable brown pelican foraging habitat consisting of relatively warm, fairly shallow brackish water where fish are close enough to the surface to be captured by these plunge-diving birds.

Near the planning area, brown pelicans are known to occur in the open-water and marsh habitats of the Palo Alto Baylands to the south (eBird 2013) and likely forage in similar habitats within the planning area. However, the species is expected to occur only in low numbers due to the shallow nature of the Bay waters within the planning area.

White-tailed Kite (*Elanus leucurus*). Federal Listing Status: None; State Listing Status: Fully Protected. In California, white-tailed kites can be found in the Central Valley and along the coast, in grasslands, agricultural fields, cismontane woodlands, and other open habitats (Zeiner et al. 1990a, Dunk 1995, Erichsen et al. 1996). White-tailed kites are year-round residents of the state, establishing nesting territories that encompass open areas with healthy prey populations, and snags, shrubs, trees, or other nesting substrates (Dunk 1995). Nonbreeding birds typically remain in the same area over the winter, although some movements do occur (Polite 1990). The presence of white-tailed kites is closely tied to the presence of prey species, particularly voles, and prey base may be the most important factor in determining habitat quality for white-tailed kites (Dunk and Cooper 1994, Skonieczny and Dunk 1997). Although the species recovered after population declines during the early 20th century, its populations may be exhibiting new declines as a result of recent increases in habitat loss and disturbance (Dunk 1995, Erichsen et al. 1996).

Marshes and grasslands within the planning area provide suitable breeding and foraging habitat for the white-tailed kite. Thus, one to two pairs could potentially nest within the planning area.

American Peregrine Falcon (*Falco peregrinus anatum*). Federal Listing Status: None; State Listing Status: Fully Protected. The American peregrine falcon occurs throughout much of the world, and is known as one of the fastest flying birds of prey. Peregrine falcons prey almost entirely on birds, which they kill while in flight. These falcons nest on ledges and caves on steep cliffs, as well as on human-made structures such as buildings, bridges, and electrical transmission towers. In California, they are known to nest along the entire coastline, the northern Coast, and the Cascade Ranges and Sierra Nevada.

A severe decline in populations of the widespread North American subspecies *anatum* began in the late 1940s. This decline was attributed to the accumulation of DDE, a metabolite of the organochlorine pesticide DDT, in aquatic food chains. When concentrated in the bodies of predatory birds such as the peregrine falcon, this contaminant led to reproductive effects, such as the thinning of eggshells. The American peregrine falcon was listed as endangered by the USFWS in 1970 (USFWS 1970) and by the State of California in 1971. Recovery efforts included the banning of DDT in North America, and captive breeding programs to help bolster populations. The USFWS removed the American peregrine falcon from the endangered Species List in 1999 (USFWS 1999b), and from the state endangered species list in 2009.

Electrical transmission towers over marsh habitat in the planning area provide suitable nesting habitat, and peregrine falcons have been recorded using other species' nests on such towers in the Mountain View area to the southeast. However, there are currently no records of the species nesting in the planning area. Peregrine falcons occur as occasional foragers around the tidal marsh habitats and adjacent grasslands in the planning area.

Golden Eagle (*Aquila chrysaetos*). Federal Listing Status: None; State Listing Status: Fully Protected. In California, the golden eagle is an uncommon permanent resident and migrant throughout the state. The species' breeding range within California excludes only the Central Valley, the immediate coast in the far north, and the southeastern corner of the state (Zeiner et al. 1990a). Recent declines of golden eagle populations have occurred in several western states in North America, including California, primarily because of loss of habitat and mortalities resulting from human activities (Kochert et al. 2002, Good et al. 2007). Further declines in eagle populations are expected to occur as long as habitat loss and anthropogenic landscape alteration continue (Good et al. 2007).

The golden eagle nests in a range of open habitats, including desert scrub, foothill cismontane woodlands, and annual or perennial grasslands (Zeiner et al. 1990a, Kochert et al. 2002). Golden eagle nesting habitat is characterized by large, remote patches of grassland or open woodland; a hilly topography that generates lift; an abundance of small mammal prey; and tall structures that serve as nest platforms and hunting perches (Kochert et al. 2002). Once a breeding pair establishes a territory, they may build a number of nests in tall structures such as tall trees or snags, cliffs, or utility towers (Zeiner et al. 1990a, Kochert et al. 2002), only one of which is used in any given year (Kochert et al. 2002). The eagle breeding season begins in late January and continues through August (CDFG 2008c). Following the nesting period, adult eagles usually remain in or near their breeding territory (Zeiner et al. 1990a). Young birds in California tend to be sedentary, remaining in or near their parental home ranges (Kochert et al. 2002).

In the South Bay, golden eagles nest widely in the Diablo Range and less commonly in the Santa Cruz Mountains (Bousman 2007b) primarily outside the Project Area; however, Valley floor areas adjacent to the foothills may be used (e.g., Coyote Valley and southern Santa Clara Valley) and grasslands along the San Francisco Bay margin, where perches are available, may be used for foraging. Suitable nesting habitat is not present in the planning area. However, on rare occasions, small numbers of this species may forage in open habitats (e.g., grasslands and marshes) within and adjacent to the planning area.

APPENDIX D

Noise Assessment

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CITY OF EAST PALO ALTO GENERAL PLAN UPDATE EIR DRAFT NOISE AND VIBRATION ASSESSMENT

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A. INTRODUCTION

The Noise Element of a General Plan is a comprehensive approach for including noise control in the planning process. It is a tool for achieving and maintaining environmental noise levels compatible with land use. The Noise Element identifies noise-sensitive land uses and noise sources, defines areas of noise impact, and establishes goals, policies, and programs so that residents in the City of East Palo Alto will be protected from excessive noise. The Noise Element also presents information regarding sources of ground vibration such as construction activities and railroad trains.

This report summarizes information on the noise and vibration environment in the City of East Palo Alto and provides an evaluation of the effects of the proposed General Plan update on noise. A brief discussion of noise and vibration concepts is presented to assist the reader in understanding the discussion. The report focuses on the predominant sources of environmental noise that affect the City, including vehicular traffic, aircraft, and railroad trains. Impacts resulting from the General Plan Update are discussed and mitigation measures, in the form of policy recommendations, are provided.

B. NOISE AND VIBRATION CONCEPTS

1. Terminology

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA)*. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise* descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level (CNEL)* is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level (L_{dn} or DNL)* is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

2. Effects of Noise

a. Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard which is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

b. Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows with Sound Transmission Class ratings greater than 30 STC.

c. Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. Therefore, there is an increase in annoyance due to ground vehicle noise of about 1 percent per dBA between a L_{dn} of 60-70 dBA. Between a L_{dn} of 70-80 dBA, each decibel increase increases the percentage of the population highly annoyed by about 2 percent. People appear to respond more adversely to aircraft noise. When the L_{dn} due to aircraft noise is 60 dBA, approximately 10 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase in aircraft noise results in about a 3 percent increase in the percentage of the population highly annoyed.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

3. Ground Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the Peak Particle Velocity (PPV) and another is the Root Mean Square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans (60 to 70 VdB). Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Table 3 illustrates some common sources of vibration and the association to human perception or the potential for structural damage. Construction activities, train operations, and heavy truck and bus traffic are some of the most common external sources of vibration that can be perceptible inside residences.

TABLE 3 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, May 2006.

a. Construction Vibration

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

Table 4 displays continuous vibration impacts on human annoyance and on buildings. As discussed previously, annoyance is a subjective measure and vibrations may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

TABLE 4 Reactions of People and Damage to Buildings From Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

b. Rail Vibration

Railroad operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the RMS velocity level of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10-6 in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration levels in decibels to reduce the potential for confusion with airborne sound levels in decibels.

One of the problems with developing suitable criteria for groundborne vibration is the limited research into human response to vibration and more importantly human annoyance inside buildings. The U.S. Department of Transportation (U.S. DOT) Federal Transit Administration (FTA) has developed rational vibration limits that can be used to evaluate human annoyance to groundborne vibration. These limits are summarized in Table 5. These criteria are primarily based on experience with passenger train operations, such as rapid transit and commuter rail systems. The main difference between passenger and freight operations is the time duration of individual events; a passenger train lasts a few seconds whereas a long freight train may last several minutes, depending on speed and length.

TABLE 5 FTA Groundborne Vibration Impact Criteria

Land Use Category	Impact Levels (VdB re 1 micro-inch /sec)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Source: US Department of Transportation Federal Transit Administration 2006
Notes:

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events per day. This category includes most commuter rail systems.
4. This limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.

c. Vibration from Heavy Trucks and Buses

Groundborne vibration levels from heavy trucks and buses are not normally perceptible, especially if roadway surfaces are smooth. Buses and trucks typically generate groundborne vibration levels to about 63 VdB at a distance of 25 feet when traveling at a speed of 30 mph. Higher vibration levels can occur when buses or trucks travel at higher rates of speed or when the pavement is in poor condition. Vibration levels below 65 VdB are below the threshold of human perception.

C. REGULATORY FRAMEWORK

The federal government, State of California, and the City of East Palo Alto establish regulatory criteria in the form of guidelines, regulations, and policies that are designed to limit noise exposure at noise-sensitive land uses. Federal and State Agencies, Appendix G of the State California Environmental Quality Act (CEQA) Guidelines, the City of East Palo Alto General Plan, and the City of East Palo Alto Municipal Code present the following:

1. Federal

a. Department of Housing and Urban Development (HUD)

HUD environmental criteria and standards are presented in 24 CFR Part 51. New residential construction qualifying for HUD financing proposed in high noise areas (exceeding 65 dBA L_{dn}) must incorporate noise attenuation features to maintain acceptable interior noise levels. A goal of 45 dBA L_{dn} is set forth for interior noise levels and attenuation requirements are geared toward achieving that goal. It is assumed that with standard construction any building will provide sufficient attenuation to achieve an interior level of 45 dBA L_{dn} or less if the exterior level is 65 dBA L_{dn} or less. Approvals in a "normally unacceptable noise zone" (exceeding 65 dBA but not exceeding 75 dBA) require a minimum of 5 dBA additional noise attenuation for buildings if the day-night average is greater than 65 dBA but does not exceed 70 dBA, or minimum of 10 dBA of additional noise attenuation if the day-night average is greater than 70 dBA but does not exceed 75 dBA.

b. Federal Highway Administration (FHWA)

Proposed federal or federal-aid highway construction projects at a new location, or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment, or increases the number of through-traffic lanes requires an assessment of noise and consideration of noise abatement per Title 23 of the Code of Federal Regulations, Part 772 (23 CFR Part 772), “Procedures for Abatement of Highway Traffic Noise and Construction Noise.” FHWA has adopted noise abatement criteria (NAC) for sensitive receivers such as picnic areas, recreation areas, playgrounds, active sport areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals when “worst-hour” noise levels approach or exceed 67 dBA L_{eq}. The California Department of Transportation (Caltrans) has further defined approaching the NAC to be 1 dBA below the NAC for noise-sensitive receivers identified as Category B activity areas (e.g., 66 dBA L_{eq} is considered approaching the NAC).[1]

c. Federal Transit Administration (FTA) – Train Vibration

The FTA has identified vibration impact criteria for sensitive buildings, residences, and institutional land uses near rail transit and railroads. The thresholds for residences and buildings where people normally sleep (e.g., nearby residences) are 72 VdB for frequent events (more than 70 events of the same source per day), 75 VdB for occasional events (30 to 70 vibration events of the same source per day), and 80 VdB for infrequent events (less than 30 vibration events of the same source per day).

[1] Traffic Noise Analysis Protocol, Caltrans Division of Environmental Analysis, May, 2011.

2. State of California

a. California Administrative Code Section 65302(f)

California Government Code Section 65302(f) requires that all General Plans include a Noise Element to address noise problems in the community. The Noise Element shall recognize the guidelines established by the Office of Noise Control in the State Department of Health Services and shall analyze and quantify, to the extent practicable, as determined by the legislative body, current and projected noise levels for all of the following sources:

- Highways and freeways.
- Primary arterials and major local streets.
- Passenger and freight on-line railroad operations and ground rapid transit systems.
- Commercial, general aviation, heliport, military airport operations, aircraft flyovers, jet engine tests stands, and all other ground facilities and maintenance functions related to airport operation.
- Local industrial plants, including, but not limited to, railroad classification yards.
- Other stationary ground noise sources identified by local agencies as contributing to the community noise environment.

Noise contours shall be shown for all of these sources and stated in terms of CNEL or L_{dn}. The noise contours shall be prepared on the basis of noise monitoring or following generally accepted noise modeling techniques for the various sources identified above.

The noise contours shall be used as a guide for establishing a pattern of land uses in the land use element that minimizes the exposure of community residents to excessive noise. The noise element shall include implementation measures and possible solutions that address existing and foreseeable noise problems, if any. The adopted noise element shall serve as a guideline for compliance with the state's noise insulation standards.

b. California Noise Insulation Standards

In 1974 the State of California established minimum noise insulation performance standards for hotels, motels, dormitories, apartment houses, and dwellings other than detached single-family dwellings in Title 25 of the California Administrative Code. These standards were ultimately implemented through Title 24 and the various versions of the California Building Code (most recently Chapter 12, Appendix Section 1207.11 of the 2010 Code). The noise limit was a maximum interior noise level of 45 dBA L_{dn}/CNEL. Where exterior noise levels exceed 60 dBA L_{dn}/CNEL, a report must be submitted with the building plans describing the noise control measures that have been incorporated into the design of the project to meet the noise limit. The State Office of Planning and Research (OPR) Guidelines require the General

Plan to facilitate the implementation of the Building Code noise insulation standards. However, the 2013 update (which became effective January 1, 2014) did not include this section of the State Building Code. Most jurisdictions have adopted policies that implement the limits in the Code and extend them to all residential development.

c. Division of Aeronautic Noise Standards

Title 21 of the California Code of Regulations[2] sets forth the State's airport noise standards. In the findings described in Section 5006, the standard states the following: "A level of noise acceptable to a reasonable person residing in the vicinity of an airport is established as a CNEL value of 65 dB for purposes of these regulations. This criterion level has been chosen for reasonable persons residing in urban residential areas where houses are of typical California construction and may have windows partially open. It has been selected with reference to speech, sleep, and community reaction." Based on this finding, the airport noise standard as defined in Section 5012 is set at a CNEL of 65 dBA.

d. California Department of Transportation (Caltrans) – Construction Vibration

Caltrans recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards. A conservative vibration limit of 0.25 to 0.30 in/sec PPV has been used for older buildings that are found to be structurally sound but cosmetic damage to plaster ceilings or walls is a major concern. For historic buildings or buildings that are documented to be structurally weakened, a conservative limit of 0.08 in/sec PPV is often used to provide the highest level of protection. All of these limits have been used successfully and compliance to these limits has not been known to result in appreciable structural damage. All vibration limits referred to herein apply on the ground level and take into account the response of structural elements (i.e. walls and floors) to groundborne excitation.

3. City of East Palo Alto

a. City of East Palo 1999 General Plan

The Noise Element of East Palo Alto's General Plan is intended to reduce noise impacts through proper planning and correction of noise problems.

It also aims to minimize the effects of noise within the community, including noise from transportation as well as other sources. To accomplish this intent, the Noise Element contains goals and policies calling for noise control measures in new construction and appropriate siting of new land uses based on potential conflicts from noise. It also calls for the reduction of transportation-related noise impacts on sensitive land uses such as residences.[3]

[2] California Code of Regulations Airport Noise Standards, Title 21, Public Works Division 2.5, Division of Aeronautics (Department of Transportation), Chapter 6 Noise Standards, Article 1.General.
[3] City of East Palo Alto, 1999, *City of East Palo Alto General Plan*, Noise Element, page 4.

To ensure that noise producers do not adversely affect sensitive land uses, the City uses land use compatibility standards when making planning and development decisions. Table 6 summarizes the Noise Element's standards for various types of land uses, which are derived from Title 24 in the California Code of Regulations. The standards represent the maximum allowable noise level and are used to determine noise impacts. The noise standards act as City policy for acceptable noise levels for development.

The noise standards are the basis for the Noise Element's land use compatibility guidelines, which are presented in a matrix in Table 7. The primary purpose of the noise/land use matrix is to identify conflicts between proposed land uses and the existing and future noise environment. It achieves this purpose by establishing three zones for the regulation of projects with respect to noise. Builders of projects in East Palo Alto are required to demonstrate that the noise standards will be met prior to project approval.

TABLE 6 Interior and Exterior Noise Standards

Land Use	Noise Standards[a]	
	Interior[b,c]	Exterior
Residential – single-family, multi-family, duplex, mobile home	CNEL 45 dB	CNEL 65 dB[d]
Residential – transient lodging, hotels, motels, nursing homes, hospitals	CNEL 45 dB	CNEL 65 dB[d]
Private offices, church sanctuaries, libraries, board rooms, conference rooms, theaters, auditoriums, concert halls, meeting halls, etc.	L_{eq} (12) 45 dB(A)	--
Schools	L_{eq} (12) 45 dB(A)	L_{eq} (12) 45 dB(A)[e]
General offices, reception, clerical, etc.	L_{eq} (12) 50 dB(A)	--
Bank lobby, retail store, restaurant, typing pool, etc.	L_{eq} (12) 55 dB(A)	--
Manufacturing, kitchen, warehousing, etc.	L_{eq} (12) 65 dB(A)	--
Parks, playgrounds	--	CNEL 65 dB(A)[e]
Golf courses, outdoor spectator sports, amusement parks	--	CNEL 70 dB(A)[e]

Source: East Palo Alto General Plan, 1999.
[a] CNEL = Community Noise Equivalent Level. L_{eq}(12) = The A-weighted equivalent sound level averaged over a 12-hour period (usually the hours of operation).
[b] Noise standards with windows closed. Mechanical ventilation shall be provided per UBC requirements to provide a habitable environment.
[c] Indoor environment excluding bathrooms, toilets, closets, and corridors.
[d] Outdoor environment limited to rear yard of single-family homes, multi-family patios, and balconies (with a depth of 6 feet or more) and common recreation areas.
[e] Outdoor environment limited to playground areas, picnic areas, and other areas of frequent human use.

TABLE 7 Noise/Land Use Compatibility Matrix

Land Use Categories	Community Noise Equivalent Level (CNEL, dBA)						
	55	60	65	70	75	80	
Residential – Single-Family, Multi-Family, Duplex	A	A	B	B	C		
Residential – Mobile Homes	A	A	B	C	C		
Transient Lodging – Motels, Hotels	A	A	B	B	C	C	
Schools, Libraries, Churches, Hospitals, Nursing Homes	A	A	B	C	C		
Auditoriums, Concert Halls, Amphitheaters, Meeting Halls	B	B	C	C			
Sports Arenas, Outdoor Spectator Sport, Amusement Parks	A	A	A	B	B		
Playgrounds, Neighborhood Parks	A	A	A	B	C		
Golf Courses, Riding Stables, Cemeteries	A	A	A	A	B	C	C
Office and Professional Buildings	A	A	A	B	B	C	
Commercial Retail, Banks, Restaurants, Theaters	A	A	A	A	B	B	C
Industrial, Manufacturing, Utilities, Wholesale, Service Stations	A	A	A	A	B	B	B
Agriculture	A	A	A	A	A	A	A

Source: East Palo Alto General Plan, 1999.

Zone A – Clearly Compatible – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

Zone B – Conditionally Acceptable – New construction or development should be undertaken only after detailed analysis of the noise reduction requirement is made and needed noise insulation features in the design are determined. Conventional construction, with closed windows and fresh air supply systems or air conditioning will normally suffice.

Zone C – Normally Incompatible – New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of noise reduction requirements must be made and needed noise insulation features included in the design.

Note: Shaded areas indicate new construction or development should generally not be undertaken.

If the noise level of a project falls within Zone A or Zone B, the project is considered compatible with the noise environment. Zone A implies that no mitigation will be needed. Zone B implies that minor soundproofing of the structure may be needed to meet City noise standards.

If the noise level of a project falls within Zone C, substantial noise mitigation will be necessary to meet the noise standards. Mitigation may involve construction of noise barriers and substantial sound insulation in buildings. Project proponents must demonstrate that the noise standards will be met prior to issuance of a building permit. If the noise level falls outside of Zones A, B, and C, the project is considered clearly incompatible with the noise environment and should not be approved.

When noise-sensitive land uses are proposed within the 60 dB CNEL or greater contour, an acoustical analysis must be prepared. For a project to be approved, the analysis must demonstrate that the project is designed to attenuate noise to meet the City noise standards, as defined in Table 8. If the project is not designed to meet the noise standards, mitigation measures can be recommended in the analysis. If the analysis demonstrates that the noise standards can be met through implementation of the mitigation measures, the project can be approved with the mitigation measures required as conditions of project approval.[4]

b. City of East Palo Municipal Code

Chapter 8.52, Noise Control, in the City's Municipal Code seeks to protect the citizens of East Palo Alto from unnecessary, excessive, and annoying noise; to maintain quiet in areas where noise levels are low; and to implement programs to reduce unacceptable noise. The regulations limit the amount of noise that may be created as measured at the exterior of any dwelling unit, school, hospital, church, or public library. Table 8 provides the Municipal Code's exterior noise standards. In addition, Chapter 8.52 limits the creation of noise that results in excessive noise levels within any dwelling unit. Table 9 provides the standards for interior noise in dwelling units. Exceptions to these standards are provided for activities such as special events and permitted daytime construction.[5]

c. Santa Clara County Comprehensive Land Use Plan

The easternmost portion of East Palo Alto is subject to noise of 60 dB from aircraft operations at Palo Alto Municipal Airport, located in Santa Clara County. The Santa Clara County Airport Land Use Commission (ALUC) provides development standards to minimize impacts from aircraft noise in the Comprehensive Land Use Plan (CLUP). To conform to the CLUP, the City has designated land within the 60 dB CNEL contour for non-residential uses such as industrial and commercial uses.[6]

[4] City of East Palo Alto, 1999, *City of East Palo Alto General Plan*, Noise Element, pages 6 through 11.
[5] City of East Palo Alto, 2009, *East Palo Alto Municipal Code*, Chapter 8.52, Noise Control.
[6] City of East Palo Alto, 1999, *City of East Palo Alto General Plan*, Noise Element, page 11.

TABLE 8 Exterior Noise Level Standards for Single- or Multi-Family Residences, Schools, Hospitals, Churches, and Public Libraries

Category	Cumulative Number of Minutes in Any 1-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7:00 am – 10:00 pm)	Nighttime (10:00 pm – 7:00 am)
1	30	55	50
2	15	50	55
3	5	65	60
4	1	70	60
5	0	75	70

Source: City of East Palo Alto Municipal Code, 2009.

Notes:

A. In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

B. Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

C. If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in this table.

TABLE 9 Interior Noise Level Standards – Dwelling Unit

Category	Cumulative Number of Minutes in Any 1-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7:00 am – 10:00 pm)	Nighttime (10:00 pm – 7:00 am)
1	5	45	40
2	1	50	45
3	0	55	50

Source: City of East Palo Alto Municipal Code, 2009.

Notes:

D. In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

E. Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

F. If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in this table.

D. NOISE AND VIBRATION IN EAST PALO ALTO

1. General Plan Update Noise Measurement Survey

A noise measurement survey was completed to establish existing noise levels in the City of East Palo Alto. There were several purposes for the noise measurements. Long-term (LT) measurements made hour-by-hour over a period of 24 hours or more provide information on how noise levels vary throughout the day and night and how noise levels may vary from day-to-day. A series of attended short-term (ST) measurement were also made, which are useful for several purposes. The person attending the measurements can identify the noise sources that occur during the measurement and note the level of noise associated with identifiable events. This assists in quantitatively and qualitatively characterizing the noise environments along the major roadways and also in the quieter areas of the City.

The State OPR Guidelines related to the preparation of the Noise Element of the General Plan mandate that noise exposure levels be prepared in terms of the L_{dn} or the CNEL. Both of these descriptors were described previously and represent the 24-hour average noise level with weighted periods for the nighttime (L_{dn}) or weighted periods for the nighttime and evening (CNEL). CNEL is currently the preferred metric and is used in this report to characterize the 24-hour average noise exposure level. It is also important to know how noise levels vary within each hour of the day and night. For this purpose, standard acoustical descriptors were measured and reported. These standard statistical descriptors are the L_{max}, L_1, L_{10}, L_{50}, L_{90}, and the L_{min}. The L_{max} and L_{min} noise levels are the highest and lowest noise levels during the interval, and the L_1, L_{10}, L_{50}, and L_{90} represent sound levels exceeded 1 percent, 10 percent, 50 percent (the median level), and 90 percent of the time interval (representing the background noise levels). The hourly equivalent sound level (L_{eq}), the basis for the community noise equivalent levels, was measured and reported for each hour as well.

Noise from transportation activity is the primary component of the noise environment in East Palo Alto. Transportation corridors that traverse East Palo Alto, such as U.S. Highway 101 (U.S. 101), State Route 114 (SR 114), and State Route 109 (SR 109); major arterial roadways, such as University Avenue and Bay Road; and collector roadways, such as Clarke and Pulgas Avenues, are the predominant sources of environmental noise.

The noise survey was conducted from Tuesday, April 21, 2015 to Tuesday, April 28, 2015. During the noise survey, a total of 16 long-term and 14 short-term noise measurements were made, and the noise monitoring locations are shown on Figure 1. Weather conditions at the time of testing were moderate in terms of temperature and wind. The noise survey was conducted with Larson Davis Laboratories Type 820 precision sound level meters. Instrumentation was calibrated at the beginning of the noise survey and post calibrated at the end of the survey. No calibration corrections were necessary. During the survey, the microphones were fitted with windscreens. Long-term noise measurement data is shown in the Appendix of this report.

Measurement LT-1 was located at the corner of Willow Road (SR 114) and Alberni Street, approximately 70 feet east of the centerline of Willow Road (SR 114) and approximately 65 feet north of the centerline of Alberni Street. The measurement position represented the side yard equivalent of the single-family residence at 915 Alberni Street. Vehicular traffic was the dominant noise source affecting the noise measurement. The average community noise equivalent level at this location ranged from 73 to 75 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 67 to 73 dBA, and typical nighttime L_{eq} noise levels ranged from 61 to 70 dBA.

Located at the end of Westminster Avenue, LT-2 was approximately 145 feet north of the centerline of Alberni Street. Measurement LT-2 was positioned along the boundary of industrial/commercial land uses, which would be the dominant noise source at this location. The average community noise equivalent level at this location ranged from 60 to 62 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 55 to 68 dBA, and typical nighttime L_{eq} noise levels ranged from 46 to 57 dBA.

At the corner of Newbridge Street and Jervis Avenue, noise measurement LT-3 was positioned outside of Calvary Temple Church, located at 1207 Jervis Avenue. LT-3 was approximately 30 feet north of the centerline of Newbridge Street and approximately 40 feet west of the centerline of Jervis Avenue. Vehicular traffic along Newbridge Street was the major source of noise. The average community noise equivalent level ranged from 69 to 70 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 63 to 73 dBA, and typical nighttime L_{eq} noise levels ranged from 53 to 66 dBA.

Measurement LT-4 was positioned in a tree in the front yard equivalent of 2163 Ralmar Avenue. LT-4 was approximately 20 feet west of the centerline of Ralmar Avenue, approximately 280 feet north of East Bayshore Road, and approximately 340 feet north of the nearest through lane along U.S. 101. Vehicular traffic along U.S. 101 was the dominant noise source contributing to the LT-4 noise measurement. The average community noise equivalent level at this location ranged from 67 to 71 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 58 to 81 dBA, and typical nighttime L_{eq} noise levels ranged from 48 to 61 dBA.

LT-5 was located along West Bayshore Road at the corner of Donohoe Street. This measurement was made approximately 25 feet south of the centerline of Donohoe Street, approximately 40 feet west of the centerline of West Bayshore Road, and approximately 95 feet west of the centerline of the nearest through lane along U.S. 101. The dominant noise source contributing to the measurement of LT-5 was vehicular traffic along U.S. 101. The average community noise equivalent level ranged from 70 to 72 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 62 to 69 dBA, and typical nighttime L_{eq} noise levels ranged from 58 to 69 dBA.

Measurement LT-6 was located in Bell Street Park, approximately 70 feet west of the centerline of University Avenue. LT-6 was positioned just south of the parking lot, and the dominant noise source was the vehicular traffic along University Avenue. The average community noise equivalent level at this location ranged from 66 to 69 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 61 to 71 dBA, and typical nighttime L_{eq} noise levels ranged from 54 to 64 dBA.

Located at the corner of Bay Road and Gloria Way, LT-7 represented the side yard equivalent of the residence at 1531 Bay Road. LT-7 was approximately 75 feet north of the centerline of Bay Road, and vehicular traffic along Bay Road was the major source of noise. The average community noise equivalent level at this location ranged from 69 to 71 dBA CNEL from Tuesday, April 21, 2015 to Thursday, April 23, 2015. Typical daytime L_{eq} noise levels ranged from 62 to 73 dBA, and typical nighttime L_{eq} noise levels ranged from 51 to 69 dBA.

The final long-term measurement that was taken from Tuesday, April 21, 2015 to Thursday, April 23, 2015 was LT-8. This measurement was located at the corner of Scofield Avenue and Circle Drive, west of U.S. 101. LT-8 was approximately 40 feet south of the centerline of Scofield Avenue and approximately 15 feet east of the centerline of Circle Drive. Single- and multi-family residences were located in the vicinity of LT-8. Vehicular traffic along U.S. 101 was the dominant noise source affecting the noise measurement. The average community noise equivalent level at this location ranged from 62 to 65 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 56 to 74 dBA, and typical nighttime L_{eq} noise levels ranged from 45 to 61 dBA.

LT-9 through LT-16 made measurements from Thursday, April 23, 2015 to Tuesday, April 28, 2015. LT-9 was located at the corner of University Avenue and Michigan Avenue, in the front yard equivalent of the single-family residence at 1606 Michigan Avenue. This measurement was approximately 70 feet east of the centerline of University Avenue and approximately 20 feet south of the centerline of Michigan Avenue. Vehicular traffic along University Avenue was the dominant noise source at this location. The average community noise equivalent level at this location ranged from 72 to 74 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 66 to 72 dBA, and typical nighttime L_{eq} noise levels ranged from 59 to 70 dBA.

At the corner of University Avenue and Purdue Avenue, LT-10 represented the front yard equivalent of 1610 Purdue Avenue. This measurement was approximately 50 feet east of the centerline of University Avenue and approximately 25 feet south of the centerline of Purdue Avenue. Vehicular traffic along University Avenue was the dominant noise source at this location. The average community noise equivalent level at this location ranged from 73 to 77 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 68 to 78 dBA, and typical nighttime L_{eq} noise levels ranged from 60 to 72 dBA.

LT-11 was measured at the eastern end of Tulane Avenue in the front yard equivalent of 1775 Tulane Avenue. LT-11 was approximately 20 feet north of the centerline of Tulane Avenue, and at this location, the dominant noise source was vehicular traffic along Bayfront Expressway (SR 109). The average community noise equivalent level at this location ranged from 61 to 63 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 53 to 66 dBA, and typical nighttime L_{eq} noise levels ranged from 44 to 60 dBA.

Measurement LT-12 was made at Jack Farrell Park, approximately 165 feet west of the centerline of Illinois Street and approximately 340 feet east of the centerline of Fordham Street. This park included a baseball field and was surrounded by single-family residences. The noise environment was quiet with occasional aircraft noise. The average community noise equivalent level at this location ranged from 58 to 60 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 50 to 61 dBA, and typical nighttime L_{eq} noise levels ranged from 45 to 57 dBA.

Located along East Bayshore Road, approximately 400 feet to the south of Pulgas Avenue, was LT-13. This measurement was made near the driveway for a Public Storage facility. LT-13 was approximately 35 feet east of the centerline of East Bayshore Road and approximately 75 feet east of the centerline of the nearest through lane along U.S. 101, which dominates the noise environment at this location. The average community noise equivalent level at this location ranged from 78 to 81 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 72 to 78 dBA, and typical nighttime L_{eq} noise levels ranged from 67 to 77 dBA.

LT-14 was measured along Pulgas Avenue, adjacent to single-family residences. This measurement was the side yard equivalent of 939 Mouton Circle and was approximately 20 feet west of the centerline of Pulgas Avenue. The dominant noise source at LT-14 would be the vehicular traffic along Pulgas Avenue. The average community noise equivalent level at this location ranged from 64 to 66 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 57 to 68 dBA, and typical nighttime L_{eq} noise levels ranged from 50 to 63 dBA.

Long-term measurement LT-15 was located at Martin Luther King Park, near the picnic benches behind home plate of the baseball field. LT-15 was approximately 65 feet west of the centerline of Daisy Lane and approximately 195 feet east of the centerline of Larkspur Drive. The noise environment at LT-15 was typically quiet with the occasional aircraft noise. The average community noise equivalent level at this location ranged from 60 to 61 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 51 to 70 dBA, and typical nighttime L_{eq} noise levels ranged from 38 to 56 dBA.

The final long-term measurement, LT-16, was made at Cooley Landing. LT-16 was approximately 75 feet north of the centerline of Bay Road, and the noise environment at this location was typically quiet with the occasional aircraft noise. The average community noise equivalent level at this location ranged from 63 to 64 dBA CNEL. Typical daytime L_{eq} noise levels ranged from 50 to 75 dBA, and typical nighttime L_{eq} noise levels ranged from 38 to 55 dBA.

A total of 14 short-term noise measurements were made during the noise survey. Measurements ST-1 through ST-3 were made during the afternoon on April 21, 2015; ST-4 through ST-6, ST-8, and ST-9 were made on April 23, 2015; and during the morning of April 28, 2015, ST-7 and ST-10 through ST-14 were made. The measured data are summarized in Table 10. ST-1 was located in the front yard equivalent of 1161 Pierce Road, with the dominant noise source being vehicular traffic along Willow Road (SR 114). ST-2 was measured at the corner of Newbridge Street and Mello Street, where vehicular traffic along Newbridge Street was the dominant source of noise. At the corner of East Bayshore Road and Menalto Avenue, ST-3 was made; vehicular traffic along U.S. 101 was the dominant contributor to measured noise levels. Vehicular traffic along U.S. 101 was also the dominant noise source at ST-4, which was located in the front yard equivalent of 2064 Ralmar Avenue. At the northernmost terminus of Ralmar Avenue, ST-5 was measured. This measurement was dominated by the industrial/commercial land uses. ST-6 was measured at the corner of University Avenue and Sacramento Street in the front yard equivalent of 578 Sacramento Street. At this location, vehicular traffic along University Avenue was the dominant noise contributor. At the westernmost terminus of Tulane Avenue, ST-7 was measured. Vehicular traffic along Bayfront Expressway (SR 84) and University Avenue were the dominating noise sources at this location. ST-8 was located at the corner of West Bayshore Road and Newell Road near the parking lot of a convenience store. The dominant noise source was the vehicular traffic along U.S. 101. ST-9 was measured at the corner of Bay Road and Gonzaga Street, in the front yard equivalent of 2400 Gonzaga Street. At this location, Bay Road vehicular traffic was the dominant noise source. ST-10 was located at the corner of Weeks Street and Clarke Avenue at the East Palo Alto Sanitary District building. Local traffic along Weeks Street and Clarke Avenue was the dominant source of noise at this location. Located in the northwest corner of Donohoe Street and Clarke Avenue was ST-11. This measurement was made in the front yard equivalent of 895 Donohoe Street, and the dominant noise source was the local traffic along each of the intersecting roadways. ST-12 was made in the side yard equivalent of 2245 Pulgas Avenue at the corner of Garden Street. Vehicular traffic along Pulgas Avenue was the dominant source of noise at this location. ST-13 and ST-14 were measured in the residential neighborhoods located in the southeastern corner of the City, just north of U.S. 101. ST-13 was made in the Daphne Court cul-de-sac. Local traffic along the nearby neighborhood roadways dominated the noise environment at this location. ST-14 was made at the easternmost terminus of O'Connor Street. At this location, the noise environment is quiet with occasional aircraft noise.

FIGURE 1 Noise Measurement Locations in East Palo Alto

TABLE 10 Summary of Short-Term Noise Measurement Data

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	CNEL
ST-1: Front yard equiv. of 1161 Pierce Rd.; ~100 feet from the centerline of Willow Rd./SR 114 (4/21/2015, 13:40-13:50)	78	72	69	65	61	66	68
ST-2: Southeastern corner of Newbridge St. & Mello Ave.; ~55 feet from the centerline of Newbridge St. (4/21/2015, 13:20-13:30)	72	67	62	57	53	59	62
ST-3: Northwestern corner of E. Bayshore Rd. & Menalto Ave.; ~95 feet from the centerline of the nearest through lane of U.S. 101 (4/21/2015, 13:50-14:00)	89	79	71	65	63	69	74
ST-4: Front yard equiv. of 2064 Ralmar Ave. (4/23/2015, 10:40-10:50)	65	62	53	50	48	52	55
ST-5: Northernmost terminus of Ralmar Ave. (4/23/2015, 13:00-13:10)	66	61	56	51	49	53	56
ST-6: Southwestern corner of University Ave. & Sacramento St.; ~65 feet from the centerline of University Ave. (4/23/2015, 12:50-13:00)	77	75	72	66	55	68	68
ST-7: Westernmost terminus of Tulane Ave.; ~150 feet from the centerline of University Ave. (4/28/15, 10:50-11:00)	73	72	69	67	62	67	71
ST-8: Southwestern corner of W. Bayshore Rd. & Newell Rd.; ~90 feet from the centerline of the nearest through lane of U.S. 101 (4/23/2015, 11:00-11:10)	86	77	67	64	62	67	70
ST-9: Northeastern corner of Bay Rd. & Gonzaga St.; ~65 feet from the centerline of Bay Rd. (4/23/2015, 14:10-14:20)	75	73	67	61	53	54	70
ST-10: Northeastern corner of Clarke Ave. & Weeks St. (4/28/2015, 11:10-11:20)	72	70	65	57	50	61	63
ST-11: Northwestern corner of Clarke Ave. & Donohoe St. (4/28/2015, 10:50-11:00)	90	82	71	60	50	70	74
ST-12: Southwestern corner of Pulgas Ave. & Garden St.; ~40 feet from the centerline of Pulgas Ave. (4/28/2015, 11:30-11:40)	77	72	66	60	54	63	67
ST-13: End of Daphne Ct. (4/28/2015, 11:10-11:20)	69	66	58	48	44	55	57
ST-14: Easternmost terminus of O'Connor St. (4/28/2015, 11:30-11:40)	71	65	59	50	46	55	57

Note: CNEL approximated by correlating to corresponding period at a long-term site.

2. Railroad Noise

The Union Pacific Railroad tracks are located along the northern boundary of the City of East Palo Alto. These tracks are currently not in use, although Union Pacific reserves the right to run freight operations on these tracks.

3. Stationary Noise Sources

Commercial and industrial operations are the primary stationary noise sources that make a significant local contribution to community noise levels. Such uses can generate noise due to the regular operation of equipment, including fans, blowers, chillers, compressors, boilers, pumps, and air conditioning systems that may run continuously. Other intermittent sources of noise include horns, buzzers, and loading activities. In general, these stationary noise sources are often located in areas that are isolated from noise-sensitive land uses. However, the possibility of sensitive development encroaching on some of these stationary noise sources remains, which could result in some land use conflicts.

Noise sources that affect sensitive receptors within the community also include commercial land uses or those normally associated with and/or secondary to residential development. These include entertainment venues, nightclubs, outdoor dining areas, gas stations, car washes, fire stations, drive-thrus, air conditioning units, swimming pool pumps, school playgrounds, athletic and music events, and public parks. These non-transportation noise sources are local and typically only affect their adjacent neighbors.

4. Temporary Noise Sources

Another source of noise in East Palo Alto relates to intermittent construction activities. Construction noise can be significant for short periods of time at any particular location as a result of public improvement projects, private development projects, remodeling, etc. The highest construction noise levels are normally generated during grading and excavation, with lower noise levels occurring during building construction. Large pieces of earth-moving equipment, such as graders, scrapers, and bulldozers, generate maximum noise levels of 85 to 90 dBA, measured at a distance of 50 feet. Typical hourly average construction-generated noise levels are about 80 to 85 dBA, measured at a distance of 50 feet from the site during busy construction periods. Some construction techniques, such as impact pile driving, can generate very high levels of noise (105 dBA L_{max} at 50 feet) that are difficult to control. Construction activities can elevate noise levels at adjacent businesses and residences by 15 to 20 dBA or more.

5. Vibration

a. Transportation-Related Vibration Sources

There are currently no active rail lines within the City of East Palo Alto; however, Union Pacific reserves the right to run freight operations on these tracks. Groundborne vibration would occur in areas adjacent to fixed rail lines when railroad trains pass through East Palo Alto. Ground vibration levels along the railroad corridor would be proportional to the speed and weight of the trains, as well as the condition of the tracks, train engine, and car wheels. Vibration levels resulting from railroad trains vary by site, but are generally perceptible within 100 feet of the tracks.

b. Temporary Vibration Sources

Construction activities such as demolition, site preparation work, excavation, and foundation work can generate groundborne vibration at land uses adjoining construction sites. Impact pile driving has the potential of generating the highest ground vibration levels and is of primary concern for structural damage. Other project construction activities, such as caisson drilling, the use of jackhammers, rock drills, and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) can generate substantial vibration levels in the immediate vicinity.

E. NOISE EXPOSURE MAPS

SoundPLAN Version V7.3, a three-dimensional ray-tracing computer program, was used to calculate traffic noise levels along major roadways throughout East Palo Alto. Calculations took into account the source of noise, the frequency spectra of the noise source, and the topography of the area. The geometric data used to create the model were based on GIS information provided by *Circlepoint*. Existing and year 2040 Plus Project peak hour data and travel speeds were also input into the model. For U.S. 101, traffic volumes and truck mix data input into the model was based on information published by Caltrans. The predicted noise levels were then compared to measured noise levels for calibration purposes and adjustments were made as necessary to create an accurate model. The noise map prepared based on existing conditions is shown on Figure 2, and the noise map prepared based on year 2040 conditions is shown on Figure 3. Table 11 presents existing and year 2040 CNEL noise levels calculated at a reference distance of 75 feet from the center of the near travel lane for roadways in East Palo Alto.

FIGURE 2 Existing Traffic Noise Contours in East Palo Alto

FIGURE 3 2040 Future Plus Project Traffic Noise Contours in East Palo Alto

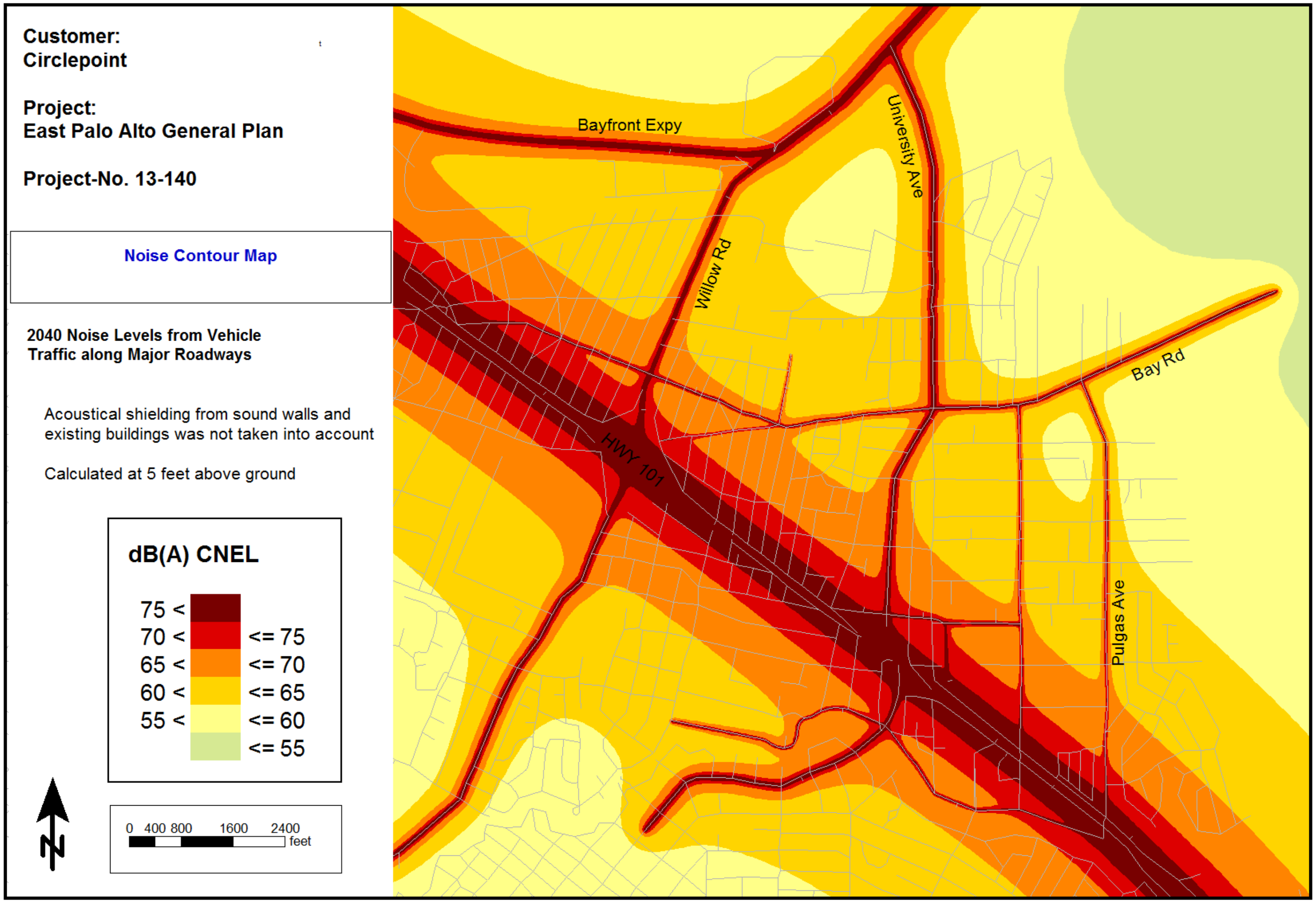


TABLE 11 Existing and 2040 Plus Project Modeled Noise Levels Along East Palo Alto Roadways

Roadway Segment	CNEL at 75 ft., dBA		Increase Over Existing
	Existing	2040 Plus Project	
Bayfront Expy—west of Willow Rd	70	71	1
Bayfront Expy—Willow Rd to University Ave	72	73	1
Bay Rd—South of Newbridge St	67	68	1
Bay Rd—Newbridge St to University Ave	64	65	1
Bay Rd—University Ave to Pulgas Ave	64	66	2
Bayshore Rd—Clark Ave to Pulgas Ave	80	80	0
Bayshore Rd—east of Pulgas Ave	79	79	0
Bayshore Rd—University Ave to Clark Ave	76	76	0
Clark Ave—Bay Rd to Bayshore Rd	63	64	1
Donohoe St—Euclid Ave to University Ave	74	75	1
Donohoe St—University Ave to Pulgas Ave	70	71	1
U.S. 101—Clark Ave to Pulgas Ave	84	85	1
U.S. 101—northwest of Willow Rd	84	85	1
Newbridge St—west of Willow Rd	68	69	1
Newbridge St—Willow Rd to Ralmar Ave	67	67	0
Pulgas Ave—Bay Rd to Myrtle St	62	63	1
Pulgas Ave—Myrtle St to Bayshore Rd	67	68	1
Ralmar St—north of Newbridge St	63	64	1
University Ave—Bay Rd to Donohoe St	69	70	1
University Ave—Bayfront Expy to Bay Rd	69	70	1
University Ave—Donohoe St to Woodland Ave	70	71	1
Willow Rd—Bayfront Expy to Newbridge St	69	69	0
Willow Rd—Newbridge St to U.S. 101	72	73	1
Woodland Ave—Euclid Ave to University Ave	68	69	1
Woodland Ave—University Ave to Cooley Ave	67	68	1

Note: Noise levels for major roadways are given at a distance of 75 feet from the center of the roadway. Noise levels for U.S. 101 are given at a distance of 75 feet from the center of the near travel lane and without existing barriers/soundwalls.

F. NOISE IMPACTS AND MITIGATION MEASURES

1. Significance Criteria

The East Palo Alto General Plan Update project consists of the development of General Plan goals and policies; the development of land use designations and identification of specific job and housing growth capacity to guide future growth; identification of targeted areas to develop or redevelop to accommodate this future economic and population growth; and setting policy for the provision of City services for new and existing development of all types for the City of East Palo Alto through the year 2040.

Standards of Significance

A significant impact will occur if implementation of the project would:

a) Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
b) Expose people to or generate excessive groundborne vibration or groundborne noise levels;
c) Create a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
d) Create a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
e) 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, expose people residing or working in the project area to excessive noise levels; or
f) For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

a) Noise and Land Use Compatibility Impact Discussion

Development facilitated by the General Plan Update project would include noise-sensitive land uses that would be located in varying noise environments. New noise-sensitive development is planned along major transportation corridors, in the vicinity of Palo Alto Airport, and in the vicinity of stationary noise sources. A significant noise impact would be identified where noise-sensitive land uses are proposed in areas where existing or future noise levels would exceed the noise and land use compatibility standards established by the City of East Palo Alto.

Impact: Existing and future noise levels at the locations of proposed residences and other noise-sensitive developments allowed for under the General Plan could exceed the City's noise thresholds of acceptability.

Single-family residential development, schools, libraries, hospitals, convalescent homes, and places of worship are considered the most noise-sensitive land uses because of the quiet nature of onsite operations. Existing and future noise levels along many roadways in the plan area currently exceed "clearly compatible" exposure levels for these types of land use. As such, noise levels at the locations of proposed residential developments and other noise-sensitive land uses allowed for under the General Plan would exceed the City's noise thresholds of acceptability.

Mixed-use development projects often include residential uses located above or in proximity to commercial uses, and in areas served bus transit along major roadways. Under the General Plan, mixed-use residential development is proposed along the Bay Road corridor where noise exposure levels would exceed those considered normally acceptable for residential uses. Noise sources associated with commercial uses could include mechanical equipment operations, public address systems, parking lot noise (e.g., opening and closing of vehicle doors, people talking, car alarms), delivery activities (e.g., use of forklifts, hydraulic lifts), trash compactors, and air compressors. These elevated noise levels, which have the potential to be generated by commercial uses within mixed-use developments, would expose nearby noise-sensitive land uses to noise levels that exceed the City's noise standards.

Noise from future trains along the Dumbarton Rail Corridor (DRC) could contribute to the future noise environment. The DRC project would extend commuter rail service across the southern portion of the San Francisco Bay between the Peninsula and the East Bay. Additionally, a Union Pacific Railroad currently runs along the northern border of East Palo Alto. As stated above, these tracks are currently not in use and Union Pacific reserves the right to run freight operations on these tracks. There are numerous uncertainties regarding these potential projects making the prediction of future day-night average noise levels from trains difficult. The calculation of daily average noise levels is highly dependent on the number and type of trains planned per day and the timing of the train passbys over the course of the day, whether during the daytime or at night.

Another important factor to consider in determining noise levels in areas near railroad corridors is shielding provided by buildings or other barriers. Day-night average noise levels commonly range from 65 to 75 dBA CNEL at land uses adjoining a railroad right-of-way. Railroad train noise levels would generally exceed 60 dBA CNEL within about 350 feet of active railroad corridors (10 to 15 trains per day). Where residential development is located adjacent to at-grade rail crossings, these sensitive uses would be subject to maximum instantaneous noise levels (L_{max}) from train warning whistles that range from approximately 90 to 110 dBA L_{max}.

Placement of residential uses within close proximity to industrial uses would also have the potential to expose residents to increased noise levels in exceedance of City noise standards. Conversely, the industrial uses could be subject to new noise standards to ensure noise level compatibility with nearby residential and mixed use neighborhoods. Industrial uses could be subject to new limitations for noise intensive activities to keep noise levels at nearby residential and mixed use neighborhoods within City noise level standards.

Where exterior transportation noise levels would exceed 60 dBA CNEL in new residential development, interior levels may exceed 45 dBA CNEL. Interior noise levels within residential units with the windows partially open and approximately 20-25 decibels lower than exterior noise levels with the windows closed, assuming typical California Building Code construction methods. Where exterior noise levels are 60 to 70 dBA CNEL, interior noise levels can typically be maintained below 45 dBA CNEL with the incorporation of an adequate forced air mechanical ventilation system in the residential units to allow residents the option of controlling noise by keeping the windows closed. In areas exceeding 70 dBA CNEL, the inclusion of windows and doors with high Sound Transmission Class (STC) ratings, and the incorporation of forced-air mechanical ventilation systems, may be necessary to meet 45 dBA CNEL.

TABLE 12 2040 General Plan Traffic Noise Contours

Roadway	Segment	Distance from Centerline to Traffic Noise Contours[1], feet		
		70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
Bayfront Expy	West of Willow Rd	87	187	402
	Willow Rd to University Ave	118	254	547
Bay Rd	South of Newbridge St	55	119	256
	Newbridge St to University Ave	35	75	162
	University Ave to Pulgas Ave	41	88	190
Bayshore Rd	Clark Ave to Pulgas Ave	348	749	1613
	East of Pulgas Ave	299	643	1384
	University Ave to Clark Ave	188	406	873
Clark Ave	Bay Rd to Bayshore Rd	30	64	138
Donohoe St	Euclid Ave to University Ave	161	348	748
	University Ave to Pulgas Ave	87	187	402
Hwy 101[3]	Clark Ave to Pulgas Ave	750[2]	1334[2]	2371[2]
	Northwest of Willow Rd	750[2]	1334[2]	2371[2]
Newbridge St	West of Willow Rd	64	138	298
	Willow Rd to Ralmar Ave	47	102	219
Pulgas Ave	Bay Rd to Myrtle St	26	55	119
	Myrtle St to Bayshore Rd	55	119	256
Ralmar St	North of Newbridge St	30	64	138
University Ave	Bay Rd to Donohoe St	75	161	357
	Bayfront Expy to Bay Rd	75	161	357
	Donohoe St to Woodland Ave	87	187	402
Willow Rd	Bayfront Expy to Newbridge St	64	138	298
	Newbridge St to U.S. 101	118	254	547
Woodland Ave	Euclid Ave to University Ave	64	138	298
	University Ave to Cooley Ave	55	119	256

Source: FHWA-RD-77-108 with traffic inputs from Nelson\Nygaard, Wiltec, and Caltrans, 2014.
[1] Distances to traffic noise contours are measured in feet from the centerlines of the roadways.
[2] Noise levels at distances greater than 500 feet from roadway centerlines are likely to change with varying atmospheric conditions.
[3] Barriers along Hwy 101 were not entered into the model and were not taken into account.

The implementation of Proposed General Plan Policies 1.29 through 1.32 and 1.35 through 1.41 would reduce potential impacts associated with new noise-sensitive land uses.

1.29 Noise standards. Use the Interior and Exterior Noise Standards (Table 9-1) for transportation noise sources. Use the City's Noise Ordinance for evaluating non-transportation noise sources when making planning and development decisions. Require that applicants demonstrate that the noise standards will be met prior to project approval.

1.30 Compatibility standards. Utilize noise/land use compatibility standards and the Noise Ordinance as guides for future planning and development decisions.

1.31 Noise control. Provide noise control measures, such as berms, walls, and sound attenuating construction in areas of new construction or rehabilitation.

1.32 Airport-adjacent land uses. Maintain the non-residential designation for land near the airport in order to prevent new noise-sensitive residential uses from being constructed in areas with excessive aircraft noise.

1.35 Highway noise barriers. Require that noise barriers are included in the design of roadway, freeway and rail improvements to mitigate significant noise impacts. Support efforts by Caltrans and other transportation providers to provide acoustical protection for noise-sensitive development (especially along Highway 101).

1.36 Vehicle noise standards. Coordinate with the California Highway Patrol and other law enforcement agencies to enforce noise standards for cars, trucks, and motorcycles.

1.37 Traffic and truck noise. Regulate traffic flow to enforce speed limits to reduce traffic noise. Periodically evaluate and enforce established truck and bus routes to avoid noise impacts on sensitive receptors.

1.38 Coordination with Airport Land Use Commission. Work with the Santa Clara County Airport Land Use Commission and the Palo Alto Airport to reduce aircraft noise in East Palo Alto.

1.39 Site design review. Utilize site design review to identify potential noise impacts on new development, especially from nearby transportation sources. Encourage the use of noise barriers (walls, berms or landscaping), setbacks and/or other buffers.

1.40 Quiet asphalt. Select a "quieter" pavement that also meets other criteria established by the City for pavements for use in resurfacing roadways. Encourage its use in future capital projects.

1.41 Noise barriers along future rail. Should commuter rail service or other significant intensification of rail use be initiated, the City shall require that Union Pacific construct noise barriers adjacent to existing unprotected residential areas near the rail line.

Proposed General Plan Policies 1.29, 1.30, 1.31, 1.39, and 1.41, in conjunction with the proposed Interior and Exterior Noise Standards shown in General Plan Table 9-1, would require that the compatibility standards be used to determine where noise levels in the community are acceptable or unacceptable, and require noise attenuation measures to achieve the acceptable noise level standards. Noise studies of new development proposals are required when existing or future noise levels from transportation or non-transportation noise sources exceed the acceptable levels for that use in order to determine the controls necessary to maintain consistency with the interior and exterior noise standards of the Safety and Noise Element. Policy 1.32 prevents the encroachment of new noise-sensitive land uses in areas near the Palo Alto Airport, and Policy 1.38 encourages the City to work in cooperation with the Santa Clara County Airport Land Use Commission to reduce aircraft noise in East Palo Alto. Policies 1.35, 1.36, 1.37, and 1.40 identify noise-reducing measures such as the requirement that noise barriers are included in the design of roadway, freeway, and rail improvement projects to reduce noise levels, that vehicle noise standards are enforced, that traffic and truck noise is regulated, and that quiet asphalt is encouraged in future capital projects to reduce noise. The proposed goals and policies of the Safety and Noise Element reduce potential impacts associated with noise and land use compatibility to a less-than-significant level by requiring project level analysis to identify mitigation measures necessary to adequately reduce transportation and non-transportation noise to acceptable levels.

Noise and Land Use Compatibility Impact Discussion for New Noise Generating Land Uses

The East Palo Alto General Plan Update project would facilitate the development of new noise-generating land uses. These new land uses could result in operational noise levels that exceed General Plan noise standards as well as noise level standards contained in the Municipal Code. A significant noise impact would be identified where the operation of noise-generating land uses would create noise levels that exceed the noise and land use compatibility of Municipal Code noise standards as established by the City of East Palo Alto.

Impact: **New noise-generating land uses or the siting of new sensitive receivers could result in noise levels that would exceed the City's noise thresholds of acceptability or Municipal Code noise limits at sensitive receivers in the vicinity.**

Mixed Use development projects often include residential uses located above or in proximity to commercial uses, and are located in areas served by rail and bus transit along major roadways and the railroad corridor. Office, commercial, retail, or other noise-generating uses developed under the General Plan could substantially increase noise levels at noise-sensitive land uses or could expose receivers to noise levels that exceed the City's Municipal Code noise limits.

Future operations at existing and proposed noise-producing land uses are dependent on many variables and information is unavailable to allow meaningful projections of noise. Noise conflicts may be caused by noise sources such as outdoor dining areas or bars, mechanical equipment, outdoor maintenance areas, truck loading docks and delivery activities, public address systems, and parking lots (e.g., opening and closing of vehicle doors, people talking, and car alarms). Development under the proposed General Plan would introduce new noise-generating sources adjacent to existing noise-sensitive areas and new noise-sensitive uses adjacent to existing noise sources.

The implementation of the following Proposed General Plan Policies would reduce potential impacts associated with new noise-producing land uses to a less-than-significant level:

1.29 Noise standards. Use the Interior and Exterior Noise Standards (Table 9-1) for transportation noise sources. Use the City's Noise Ordinance for evaluating non-transportation noise sources when making planning and development decisions. Require that applicants demonstrate that the noise standards will be met prior to project approval.

1.30 Compatibility standards. Utilize noise/land use compatibility standards and the Noise Ordinance as guides for future planning and development decisions.

1.31 Noise control. Provide noise control measures, such as berms, walls, and sound attenuating construction in areas of new construction or rehabilitation.

1.33 Noise ordinance. Continually enforce and periodically review the City's Noise Ordinance for adequacy (including requiring construction activity to comply with established work schedule limits). Amend as needed to address community needs and development patterns.

1.34 CEQA acoustical analysis. Require an acoustical analysis to evaluate mitigation measures for noise generating projects that are likely to cause the following criteria to be exceeded or to cause a significant adverse community response:

- Cause the L_{dn}/CNEL at noise-sensitive uses to increase by 3 dBA or more and exceed the "normally acceptable" level.
- Cause the L_{dn}/CNEL at noise- sensitive uses to increase 5 dBA or more and remain "normally acceptable."

New noise-generating projects implemented by the General Plan would be subject to the quantitative noise limits established in the General Plan policies and the City's Municipal Code noise standards, ensuring that existing or proposed residences and other noise-sensitive land uses would not be exposed to excessive noise. Compliance with these quantitative limits would result in a less-than-significant impact.

b) Land Use Compatibility Impact Discussion for New Vibration Sensitive Land Uses Near Railroad

Development facilitated by the General Plan could expose persons to excessive groundborne vibration levels attributable to proposed DRC trains. The proposed locations of buildings and their specific sensitivity to vibration are not known at this time; however, such uses located in close proximity to the DRC tracks could be exposed to ground vibration levels exceeding FTA guidelines.

Impact: Ground vibration levels resulting from railroad train operations at the setback of proposed residences could exceed appropriate vibration thresholds and could expose people to groundborne vibration.

Railroad trains are a source of groundborne vibration when receivers are located close to the tracks. The U.S. DOT FTA has developed vibration impact assessment criteria for evaluation vibration impacts associated with rapid transit projects.[7] The number of daily DRC commuter train passby events is anticipated to be twelve events per day. This is well within the range to be considered infrequent events per U.S. DOT criteria of less than 30 vibration events of the same source per day, setting the applicable criterion for groundborne vibration impacts at 80 VdB for proposed residences.

Information regarding vibration levels resulting from the DRC project was not available at the time of this study. As an alternative, vibration assessments prepared by *Illingworth and Rodkin Inc. (I&R)* were reviewed to estimate vibration levels near a Caltrain station[8]. Data gathered by I&R along the Union Pacific Railroad in Morgan Hill indicated that vibration levels are typically 70 VdB or less at a distance of 100 feet from the center of the near track. Vibration levels within 50 feet of the near track may exceed 75 VdB, and vibration levels within 25 feet of the near track may exceed 80 VdB.

The Mitigation Measure listed below would be required to ensure that program-level vibration impacts are reduced to a less-than-significant level.

Mitigation Measure

The City shall require the preparation of a site-specific vibration study for any residential or vibration sensitive development proposed for within 100 feet of the centerline of the railroad tracks. The study shall include recommended measures to reduce vibration to a less-than-significant level. These measures may include, but are not limited to modifications in site planning or building construction. The City shall include the recommendation(s) of site-specific vibration studies as conditions of any subsequent project approvals involving potentially significant vibration impacts. The implementation of this measure would reduce the impact to a less-than-significant level.

c) Permanent Noise Increase Impact Discussion Resulting from Increased Traffic

Development facilitated by the General Plan Update would result in increased traffic volumes along roadways throughout East Palo Alto. A significant noise impact would be identified where existing noise-sensitive land uses would be subject to permanent noise level increases of 3 dBA CNEL or more where noise levels would equal or exceed the acceptable level or 5 dBA CNEL or more where noise levels would remain at or below the acceptable level.

Impact: **Increased vehicular traffic and transportation and infrastructure improvements in the plan area would result in a permanent increase in ambient noise levels, but the increases would be considered less-than-significant.**

To describe future noise levels due to traffic, SoundPLAN 7.3 noise modeling software, which includes traffic noise calculations based on the FHWA's Traffic Noise Model (TNM) version 2.5

[7] U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, May 2006.
[8] Illingworth & Rodkin, Inc., Morgan Hill Downtown Specific Plan Environmental Noise Assessment, July 16, 2009.

model, was used to calculate traffic noise levels throughout the City. Table 12 shows the calculated distances to the 60, 65, and 70 dBA CNEL traffic noise level contours under 2040 Conditions. For reference, traffic noise level contours under 2040 Conditions are shown in Figure 3 above.

Direct inputs into the model included traffic volumes provided by *Nelson\Nygaard*, *CCAG Model*, and *Kittleson & Associates*. SoundPLAN is a three-dimensional model that uses the TNM reference noise factors for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, topography, and the acoustical characteristics of the site.

The increased development allowed under the General Plan would result in an increase in vehicular traffic, which would increase traffic noise in the plan area. To determine how changes in vehicular traffic volumes and flow would affect noise levels in the plan area, traffic noise levels were modeled for future development conditions allowed under the General Plan for the year 2040. The traffic projections included in this analysis assumed traffic growth due to the allowed development under the General Plan, as well as other planned development in surrounding areas. The following future transportation and infrastructure improvements in the plan area were also considered when modeling future traffic flow conditions.

Citywide Traffic Calming

The General Plan envisions a citywide traffic calming effort that includes roundabout, bulbouts and road diets on key thoroughfares including Pulgas Road, Clarke Road, and Bay Road. Priority locations for improvements should be on the major cut-through streets and near schools and parks as these areas have the highest levels of pedestrian activity.

Connections across U.S. 101

The General Plan includes new connections across U.S. 101 – a bridge south of University Avenue and re-opening up an existing underpass north of University Avenue.

At the program level, the projected year 2040 noise levels were compared to the existing conditions in order to determine whether the project would result in a substantial permanent increase in ambient noise levels in the plan area. A review of the data presented in Table 11 shows that noise levels in the plan area would typically increase by less than 2 dBA CNEL between 2015 and 2040 with implementation of the General Plan. Increases in vehicular traffic resulting from the anticipated development allowed under the General Plan would not substantially increase noise levels in the plan area resulting in a less-than-significant impact.

d) Impact Discussion Resulting from Temporary Construction Noise and Vibration

The proposed General Plan Update project would facilitate the construction of new projects throughout the City. Residences and businesses located adjacent to development sites would be affected at times by construction noise. Temporary construction-related noise would be considered significant if noise levels would exceed 60 dBA L_{eq} at noise-sensitive land uses (e.g., residential land uses) or 70 dBA L_{eq} at sensitive industrial, office, or commercial land uses when the noise would exceed the ambient noise environment by 5 dBA L_{eq} or more for a period of more than one construction season. Demolition and construction activities required for projects implemented by the East Palo Alto General Plan Update project may generate excessive vibration levels when heavy equipment or impact tools (e.g. jackhammers, pile drivers, hoe rams) are used in the vicinity of nearby sensitive land uses.

Impact: Construction noise would cause a temporary or periodic increase in noise exposure above ambient noise levels.

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive receptors. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), when construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction durations last over extended periods of time. For the purposes of this assessment, noise levels exceeding 60 dBA L_{eq} and the ambient noise environment by 5 dBA L_{eq} or more at nearby noise-sensitive land uses (e.g., residential land uses) for a period of more than one construction season would be considered significant. Where noise from construction activities exceeds 70 dBA L_{eq} and the ambient noise environment by 5 dBA L_{eq} or more at sensitive industrial, office, or commercial land uses for a period of more than one construction season, the impact would also be considered significant.

Major noise-generating construction activities associated with new projects would include removal of existing pavement and structures, site grading and excavation, installation of utilities, the construction of building foundations, cores, and shells, paving, and landscaping. The highest noise levels would be generated during the demolition of existing structures when impact tools are used (e.g., jackhammers, hoe rams) and during the construction of building foundations when impact pile driving is required to support the structure. Site grading and excavation activities would also generate high noise levels as these phases often require the simultaneous use of multiple pieces of heavy equipment such as dozers, excavators, scrapers, and loaders. Lower noise levels result from building construction activities when these activities move indoors and less heavy equipment is required to complete the tasks. Construction equipment would typically include, but would not be limited to, earth-moving equipment and trucks, pile driving rigs, mobile cranes, compressors, pumps, generators, paving equipment, and pneumatic, hydraulic, and electric tools. Table 13 presents the typical range of hourly average noise levels generated by different phases of construction measured at a distance of 50 feet from a busy construction site. Typical hourly average construction-generated noise levels are about 77 to 89 dBA L_{eq} measured at a distance of 50 feet from the site during busy construction periods. Large pieces of earth-moving equipment, such as graders, scrapers, and dozers, generate maximum noise levels of 85 to 90 dBA Lmax at a distance of 50 feet. During each stage of construction, there would be a different mix of equipment operating and noise levels would vary based on the amount of equipment on site and the location of the activity. Construction noise levels drop off at a rate of about 6 dBA per doubling of distance between the noise source and receptor. Intervening structures or terrain would result in lower noise levels at distant receivers.

TABLE 13 Typical Ranges of Noise Levels at 50 Feet from Construction Sites (dBA L_{eq})

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.
Source: United States Environmental Protection Agency, 1973, Legal Compilation on Noise, Vol. 1, p. 2-104.

The City of East Palo Alto does not establish quantitative noise limits for demolition or construction activities occurring in the City.

Noise generated by small infill projects facilitated by the General Plan Update would likely have relatively short overall construction durations, with the noisiest phases of construction (e.g., demolition, foundations, project infrastructure, building core, and shell) limited to a timeframe of one year or less. These phases of construction are not anticipated to generate noise levels in excess of 60 dBA L_{eq} and the ambient noise environment by 5 dBA L_{eq} or more at sensitive land uses in the area over extended periods of time (beyond one construction season). Interior construction, landscaping, and finishing activities would not be expected to result in noise levels in excess of 60 dBA L_{eq}. Large construction projects facilitated by the General Plan Update may result in a substantial temporary noise increase at adjacent noise-sensitive land uses. As a result, noise levels from these projects could exceed 60 dBA L_{eq} and the ambient noise environment by 5 dBA L_{eq} or more, and last over one year in duration.

The Mitigation Measure listed below would be required to ensure that program-level vibration impacts are reduced to a less-than-significant level.

Mitigation Measure

The City shall require that contractors use available noise suppression devices and techniques and limit construction hours near residential uses. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

A typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Limit construction activity to weekdays between 7:00 am and 7:00 pm and Saturdays and holidays between 9:00 am and 7:00 pm, with no construction on Sundays;

- Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;

- Prohibit all unnecessary idling of internal combustion engines;

- If impact pile driving is proposed, multiple-pile drivers shall be considered to expedite construction. Although noise levels generated by multiple pile drivers would be higher than the noise generated by a single pile driver, the total duration of pile driving activities would be reduced;

- If impact pile driving is proposed, temporary noise control blanket barriers shall shroud pile drivers or be erected in a manner to shield the adjacent land uses. Such noise control blanket barriers can be rented and quickly erected;

- If impact pile driving is proposed, foundation pile holes shall be pre-drilled to minimize the number of impacts required to seat the pile Pre-drilling foundation pile holes is a standard construction noise control technique. Pre-drilling reduces the number of blows required to seat the pile. Notify all adjacent land uses of the construction schedule in writing; and

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented.

Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

The potential short-term noise impacts associated with construction facilitated by the General Plan Update project would be mitigated to a less-than-significant level with the adoption and implementation of the above policy that requires reasonable noise reduction measures be incorporated into the construction plan and implemented during all phases of construction activity to minimize the exposure of neighboring properties.

Impact Discussion Resulting from Construction Vibration

Demolition and construction activities required for projects implemented by the East Palo Alto 2035 General Plan Update project may generate perceptible vibration levels when heavy equipment or impact tools (e.g. jackhammers, pile drivers, hoe rams) are used in the vicinity of nearby sensitive land uses.

Impact: **Demolition and construction activities facilitated by the Plan may expose persons to excessive vibration levels.**

The City of East Palo Alto does not establish quantitative noise limits for vibration due to demolition or construction activities occurring in the City. Table 14 presents typical vibration source levels for construction equipment. Heavy tracked vehicles (e.g., bulldozers or excavators) can generate distinctly perceptible groundborne vibration levels when this equipment operates within approximately 25 feet of sensitive land uses. Impact pile drivers can generate distinctly perceptible groundborne vibration levels at distances up to about 100 feet, and may exceed building damage thresholds within 25 feet of any building, and within 50-100 feet of a historical building, or building in poor condition.

The Mitigation Measure listed below would be required to ensure that program-level vibration impacts are reduced to a less-than-significant level.

Mitigation Measure

The City shall require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV will be used to minimize the potential for cosmetic damage to the building. A vibration limit of 0.30 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

The potential vibration impacts associated with demolition and construction activities would be mitigated to a less-than-significant level by establishing safe limits to protect structures from potential damage and would minimize vibration impacts on people and businesses.

TABLE 14 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

e) Noise and Land Use Compatibility Impact Discussion for Aircraft

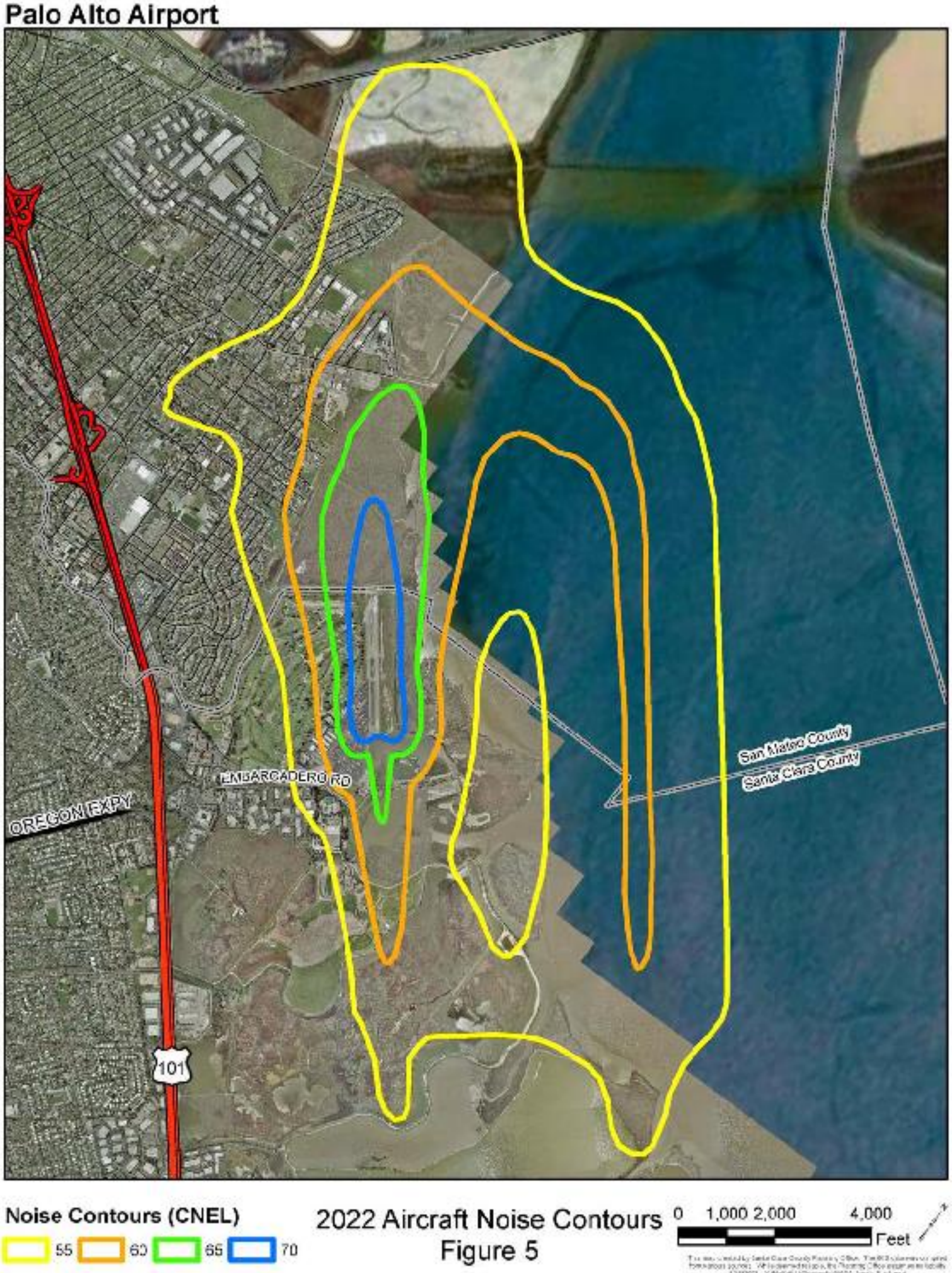
Development facilitated by the General Plan Update project would include noise-sensitive land uses in the vicinity of Palo Alto Airport. A significant noise impact would be identified where noise-sensitive land uses are proposed in areas where existing or future noise levels would exceed the Santa Clara County ALUC's maximum allowable noise level (65 dBA CNEL) considered compatible with residential uses.

Impact: **Aircraft noise over proposed noise-sensitive land uses would exceed ALUC noise thresholds, which could expose individuals living and working within the plan area to excessive aircraft noise.**

The Santa Clara County ALUC has jurisdiction over new land uses in the vicinity of airports, and establishes 65 dBA CNEL as the maximum allowable noise level considered compatible with residential uses. The East Palo Alto General Plan Update project could allow new residential development in areas of the City where aircraft noise levels associated with operations at the Palo Alto Airport would approach 65 dBA CNEL. Year 2022 aircraft noise contours from Palo Alto Airport operations are shown on Figure 4. The nearest residences within The City of East Palo Alto are located approximately ½ mile west of Palo Alto Airport. A review of the year 2022 aircraft noise contour map in the CLUP indicates that the 65 dBA CNEL contour line would not extend westward or northwest into residential neighborhood boundaries, but residential areas would be within the 55 dBA CNEL and 60 dBA CNEL aircraft noise contours.

Draft General Plan Policies 1.29, 1.32, and 1.38 would guide new development proposed for areas susceptible to noise associated with the Palo Alto Airport. Policy 1.30 would require that the General Plan compatibility standards be used to determine where noise levels in the community are acceptable or unacceptable, and require noise attenuation measures to achieve the "acceptable" noise level standards. Policy 1.32 would maintain the non-residential designation for land near the airport in order to prevent new noise sensitive residential uses from being constructed in areas with excessive aircraft noise. By ensuring compliance with the local airport land use plan and the City's normally acceptable noise level standards, implementation of these policies would effectively reduce potential program-level aircraft noise impacts to a less-than-significant level.

FIGURE 4 Noise Contours from Palo Alto Airport Operations



Source: Santa Clara County Airport Land Use Commission, *Comprehensive Land Use Plan—Palo Alto Airport*, 2008

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APPENDIX E

Traffic Impact Analysis

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East Palo Alto General Plan Update

Transportation Impact Analysis

February 2016

NELSON NYGAARD

with Kittelson & Associates

Table of Contents

Table of Figures

Table of Tables

EXECUTIVE SUMMARY

This report presents the results of the Transportation Impact Analysis (TIA) conducted for the proposed East Palo Alto General Plan Update (the Project) for the City of East Palo Alto, California.

PROJECT DESCRIPTION AND ANALYSIS PARAMETERS

The City of East Palo Alto (the Study Area) is located in San Mateo County, adjacent to San Francisco Bay and the cities of Menlo Park and Palo Alto, as shown in Figure 1. The proposed East Palo Alto General Plan Update is the result of an extensive public process undertaken to provide guidance on future development in the City. The General Plan is a planning document that assigns land use policy and associated densities and intensities to all properties within the project area. In East Palo Alto, infill development represents the primary avenue for growth. Most of East Palo Alto is built out (at lower than permitted densities) and will not realistically redevelop over the life of the plan.

Table 1 below summarizes expected growth by district and land use type under the General Plan Update. The projected additional residential growth is expected to increase the City's population by approximately 7,500 people.

Table 1 Anticipated Growth under General Plan Update

District/Area	Net New Units	New Retail	Net Office	Net Industrial
Ravenswood/4 Corners Area	835	112,400 sq. ft	1,235,853sq. ft	267,987 sq. ft
Westside (Capped at Existing G.P.)	900	45,000	0	0
2nd units on single-family parcels	119	0	0	0
Other Parcels	665	176,006 sq. ft	704,000 sq. ft	0.
TOTAL	**2,519**	**333,406 sq. ft**	**1,939,853 sq. ft**	**267,987 sq. ft**

Source: Raimi & Associates, 2015.

The purpose of this analysis is to identify the transportation impacts of potential future development within the City of East Palo Alto. Future development proposals within the City would be subject to City review for consistency with the General Plan and additional analysis may be required.

Project impacts on the study area roadway facilities were determined by measuring the effect Project traffic would have on 10 study intersections and 10 roadway study segments in the vicinity of the study area during the morning (7:00 to 9:00 a.m.) and evening (4:00 to 6:00 p.m.) peak periods. Conditions were evaluated under existing conditions, and under cumulative conditions without and with the Project. Operations of study area intersections were evaluated and lane configuration and traffic control recommendations were developed. San Mateo County City/County Association of Governments (C/CAG) designated Congestion Management Program intersections were also evaluated.

FINDINGS

Auto Delay Impact Analysis Results

Results of the Existing Conditions assessment indicate that four study intersections in the vicinity of the site currently operate with levels of automobile delay at peak hours that exceed the levels of delay deemed acceptable under the automobile level of service (LOS) standards set forth by the agencies with jurisdiction over those intersections. The results of the LOS calculations indicate that the following study intersections do not meet their designated LOS standards during at least one peak hour:

- University Avenue and Bayfront Expressway, in the City of Menlo Park (PM)
- Willow Road and Bayfront Expressway, in the City of Menlo Park (PM)
- University Avenue and Donohoe Street, in the City of East Palo Alto (AM and PM)
- East Bayshore Road and Pulgas Avenue, in the City of East Palo Alto (PM)

The results of the automobile level of service analysis also indicate that under Cumulative No Project conditions, six study intersections are projected to operate at automobile levels of service that are deemed deficient, according to the level of service standards set forth by the relevant jurisdictions, during at least one peak hour:

- University Avenue and Bayfront Expressway, in the City of Menlo Park (PM)
- Willow Road and Bayfront Expressway, in the City of Menlo Park (AM and PM)
- University Avenue and Donohoe Street, in the City of East Palo Alto (PM)
- University Avenue and Woodland Avenue, in the City of East Palo Alto (AM)
- East Bayshore Road and Pulgas Avenue, in the City of East Palo Alto (PM)
- Bay Road and Newbridge Street, in the City of East Palo Alto (AM and PM)

The Cumulative with Project conditions were evaluated relative to Cumulative No Project conditions to determine potential Project impacts. **Under Cumulative with Project conditions, relative to Cumulative No Project conditions, significant automobile delay impacts are projected to occur at two study intersections:**

- **University Avenue and Bay Road, in the City of East Palo Alto (PM)**
- **University Avenue and Donohoe Street, in the City of East Palo Alto (AM)**

To supplement the intersection level of service analysis summarized above, a Roadway study segment level of service analysis, based on average daily traffic volumes and generalized roadway capacity values, was also conducted. **Under Cumulative with Project conditions, relative to Cumulative No Project conditions, significant automobile delay impacts are projected to occur on two roadway study segments:**

- **University Avenue between Michigan Avenue and Bay Road, in the City of East Palo Alto**
- **Donohoe Street between University Avenue and Capitol Avenue, in the City of East Palo Alto**

Auto Delay Impact Mitigation Measures & Significance After Mitigation

All of the automobile delay impacts described above were deemed significant impacts according to the thresholds established by the relevant jurisdiction (the City of East Palo Alto and/or the City of Menlo Park). Attempting to mitigate these automobile delay impacts by increasing roadway capacity would require extensive right-of-way acquisition and roadway widening, and these mitigation measures were therefore deemed infeasible.

Implementation of the improved pedestrian, bicycle, and transit facilities and services, and the transportation demand management (TDM) policies, outlined in the proposed General Plan could cause a reduction in the vehicle trips generated by buildout of the Project. The proposed General Plan also includes policy of adopting a multimodal transportation impact fee, whose proceeds will be used to fund the pedestrian, bicycle, transit and TDM facilities and services outlined in the General Plan, in order to support future development within the City of East Palo Alto.

Because implementation of some proposed transit facilities and services would require additional funding from outside agencies and the approval of outside agencies and the City cannot guarantee they would be implemented, and because the effects of the pedestrian, bicycle, transit and TDM measures on vehicle trips are uncertain, the automobile delay impacts described above were determined to be significant and unavoidable.

Bicycle, Pedestrian, and Transit Impact Analysis Results

The proposed Project will increase the City's population and can therefore be expected to increase the number of pedestrians and bicyclists in various parts of the City. Bicycling and walking conditions are not expected to be adversely affected due to the project since no new roadway or intersection widenings are proposed, and since the proposed General Plan's policies will result in significant improvements to the City's bicycle and pedestrian network. **Analysis of the proposed Project therefore determined that the project has a less-than-significant impact to the bicycle and pedestrian network.**

The Project can also be expected to increase overall transit demand. Both SamTrans and Caltrain are improving service and plan to provide sufficient facilities and services to accommodate this increase in ridership, and implementation of the proposed General Plan's policies will result in significant improvements to the City's transit facilities and supporting services. **Based on the above considerations, the project has a less-than-significant impact to the transit network.**

1 INTRODUCTION

This report presents the results of the Transportation Impact Analysis (TIA) conducted for the proposed East Palo Alto General Plan Update (the Project) for the City of East Palo Alto. This chapter discusses the TIA purpose, study area, analysis methods, criteria used to identify significant impacts, and report organization.

1.1 STUDY PURPOSE

The City of East Palo Alto (the Study Area) is located in San Mateo County, California, adjacent to San Francisco Bay and the cities of Menlo Park and Palo Alto, as shown in Figure 1. The proposed East Palo Alto General Plan Update is the result of an extensive public process undertaken to provide guidance on future development in the City. The General Plan is a planning document that assigns land use policy and associated densities and intensities to all properties within the project area. In East Palo Alto, infill development represents the primary avenue for growth. Most of East Palo Alto is built out (at lower than permitted densities) and will not realistically redevelop over the life of the plan, and maximum buildout city wide would grossly overestimate and unrealistically overstate future impacts.

The General Plan Update development scenario therefore does not assume the full buildout of the plan area—the theoretical amount of development that would occur if every parcel in the plan area were rebuilt to the new maximum allowable density and intensity set forth in the General Plan Updated—because a number of limiting factors reduce the feasibility of the realization of theoretical buildout scenario. These factors include the existing urban context, policies and programs that limit new growth, setting forth a development limit, and the existing regulatory environment. As such, the City has assumed that not every property in the City and plan area would be developed at the maximum residential densities or non-residential intensities allowed by the General Plan Update.

Table 2 below summarizes expected growth by district and land use type under the General Plan Update. The projected additional residential growth is expected to increase the City's population by approximately 7,500 people.

Table 2 Anticipated Growth under General Plan Update

District/Area	Net New Units	New Retail	Net Office	Net Industrial
Ravenswood/4 Corners Area	835	112,400 sq. ft	1,235,853sq. ft	267,987 sq. ft
Westside (Capped at Existing G.P.)	900	45,000	0	0
2nd units on single-family parcels	119	0	0	0
Other Parcels	665	176,006 sq. ft	704,000 sq. ft	0.
TOTAL	**2,519**	**333,406 sq. ft**	**1,939,853 sq. ft**	**267,987 sq. ft**

Source: Raimi & Associates, 2015.

The purpose of this analysis is to identify the transportation impacts of potential future development within the City of East Palo Alto. Future development proposals within the City would be subject to City review for consistency with the General Plan and additional analysis may be required.

1.2 REGULATORY FRAMEWORK

This section outlines the regulatory setting as it relates to traffic and transportation in the Study Area.

State Agencies, Laws and Regulations

California Department of Transportation (Caltrans)

Following the passage of the Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act, known as Proposition 1b, in November 2006, Caltrans implemented a Corridor System Management Plan (CSMP) for all corridors in the state with projects funded by the Corridor Mobility Improvement Act (CMIA). A CSMP was published for the US Highway 101 South Corridor in December, 2010.[1] The report notes the segment of Highway 101 that would be affected by development in the City of East Palo Alto is already a zone of AM and PM congestion.

Caltrans has also published an advisory Guide for the Preparation of Traffic Impact Studies (2002), which includes guidance on the agency's preferred approach and suggested analysis methods. The guide was prepared in partnership with local and regional agencies. The intent of this guide is to provide a starting point and a consistent basis for Caltrans to evaluate traffic impacts to State highway facilities. The applicability of this guide for local streets and roads (non-State highways) is at the discretion of the effected jurisdiction.[2]

Regional Agencies, Regulations and Policies

Metropolitan Transportation Commission (MTC)

The Metropolitan Transportation Commission (MTC) is the transportation planning, coordinating, and financing agency for the nine-county San Francisco Bay Area. MTC is charged with regularly updating the Regional Transportation Plan (RTP), a comprehensive framework for the development of transit, highway, bicycle, pedestrian, railroad, seaport, and airport facilities in the region. The most recent RTP, known as Transportation 2035, was adopted in April 2009. The plan specifies how anticipated federal, state, and local transportation funding will be spent across the region during the 25-year plan horizon.

City/County Association of Governments of San Mateo County

The City/County Association of Governments of San Mateo County (C/CAG) is a regional planning agency involved with various public services, including transportation. In 1990, California voters passed Propositions 111 and 108, which provide funding to urban counties in California that designate a Congestion Management Agency (CMA) and prepare, implement and biennially update a Congestion Management Program (CMP). In San Mateo, C/CAG was designated as the CMA and the first CMP was adopted in 1991. The 2015 update (published September 2013) is the most recent edition of the CMP. The CMP sets standards for regional routes in San Mateo County, including all state highways, principal arterials and intersections. The CMP sets a level of service standard for each route identified, measures and evaluates current

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[1] Caltrans District 4, 2010. US 101 South Corridor System Management Plan.

[2] Caltrans, Guide for the Preparation of Traffic Impact Studies, December 2002

performance on those routes, provides a land use alternative impact analysis, and plans a seven-year capital improvement program.[3]

C/CAG also developed the San Mateo Countywide Transportation Plan 2010, adopted in January 2010.[4] The purpose of the Plan is to create a long range vision for the future of transportation within San Mateo County and neighboring counties. The Plan creates a broad policy framework for addressing various modes of transportation, including roads, Caltrain, SamTrans, BART and bikeways, together as one comprehensive transportation system. The Plan is intended to achieve goals such as reducing traffic congestion in San Mateo County; improving mobility, air quality and the coordination between land use and transportation planning; and increasing access, reliability and safety.

San Mateo County Transit District

The San Mateo County Transit District (SamTrans) is the administrative branch for the principal public transit services and transportation programs within San Mateo County. In addition, SamTrans manages the San Mateo County Transportation Authority, the agency formed to administer the proceeds of Measure A, a countywide half-cent sales tax. In 1988, voters approved Measure A to provide capital funds for Caltrain grade separation projects, and street and highway improvement projects. The measure also provides funding for Redi-Wheels, the County's paratransit service.

East Palo Alto General Plan (1999)

The current East Palo Alto General Plan, adopted in December 1999, describes the major roadways in the City. The current classifications for City streets include:

- Freeway – a multi-lane roadway with controlled access that provides regional access to the City.
- Arterial – Arterials are signalized streets that serve through traffic and provide access to major destinations.
- Collector – Streets that collect traffic from a local residential streets and distribute to arterials.
- Local – Streets that provide access to adjacent properties.

Roadways relevant to the study area are listed in Chapter 2, Existing Conditions. The 1999 General Plan and subsequently adopted supplemental policies also define the thresholds for determining the significance of traffic impacts. These are presented in Section 1.6, Significance Criteria.

1.3 SCOPE OF STUDY

Study Area

The Study Area for the Project is the City of East Palo Alto.

Study Intersections, Roadway Segments & Study Peak Hours

The Project's impacts on the study area roadway facilities were determined by measuring the effect project traffic would have on motor vehicle traffic delays at intersections in the vicinity of the study area during the morning (7:00 to 9:00 a.m.) and evening (4:00 to 6:00 p.m.) peak periods. These periods were selected for analysis because it is during these periods that the most congested traffic conditions occur on average day. A total of 10 intersections (listed below and shown in Figure 5), including eight signalized and two unsignalized

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[3] City/County Association of Governments, 2015, *Final San Mateo County Congestion Management Program 2015.*

[4] City/County Association of Governments, April 2011, *San Mateo Countywide Transportation Plan 2010.*

intersections, were selected as study locations in consultation with the City of East Palo Alto staff. The study intersections are located in the City of East Palo Alto (the Study Area), except as noted below. The intersections located outside of the Study Area were studied because they represent key locations used by vehicles traveling to and from the Study Area.

In addition, 10 roadway segments were selected as study locations in consultation with the City of East Palo Alto staff, in order to measure the effect that project traffic would have on average daily traffic (ADT) patterns on typical weekdays in East Palo Alto. These roadway segments are listed below and shown in Figure 8. All of the roadway segments are located in the City of East Palo Alto.

Study Intersections

1. University Avenue (State Route 109) and Bayfront Expressway (State Route 84)* (City of Menlo Park)
2. Willow Road (State Route 114) and Bayfront Expressway (State Route 84)* (City of Menlo Park)
3. Willow Road (State Route 114) and Newbridge Street (City of Menlo Park)
4. University Avenue (State Route 109) and Bay Road
5. University Avenue (State Route 109) and Donohoe Street
6. University Avenue and Woodland Avenue
7. Bay Road and Pulgas Avenue (unsignalized)
8. East Bayshore Road and Clarke Avenue
9. East Bayshore Road and Pulgas Avenue
10. Bay Road and Newbridge Street (unsignalized)

Study Roadway Segments

1. Bay Road between Gloria Way and University Avenue
2. University Avenue between Michigan Avenue and Bay Road
3. Runnymede Street between Cooley Avenue and Clarke Avenue
4. Euclid Avenue between Bell Street Park Place and Donohoe Street
5. Clarke Avenue between Donohoe Street and O’Connor Street
6. Pulgas Avenue between Myrtle Street and O’Connor Street
7. Donohoe Street between University Avenue and Capitol Avenue
8. East Bayshore Road between Glen Way and Euclid Avenue
9. East Bayshore Road between Clarke Avenue and Pulgas Avenue
10. West Bayshore Road between Cooley Avenue and Newell Road

Figure 1: General Plan Update Study Area

Intersections denoted with an asterisk (*) are designated as Congestion Management Program (CMP) intersections. As the Congestion Management Agency (CMA) for San Mateo County, the City/County Association of Governments of San Mateo County (C/CAG) is responsible for maintaining the performance and standards of the Congestion Management Program roadway network. As described below in Section 1.5, Analysis Methods, and Section 1.6, Significance Criteria, the level of service standards at CMP intersections are established by the CMA and may not necessarily be the same as the level of service standards of the City in which the particular intersection is located.

1.4 TRANSPORTATION ANALYSIS SCENARIOS

For this study, several scenarios were evaluated to compare their relative impacts on motor vehicle traffic flow and bicycle, pedestrian, and transit facilities and services. The following scenarios were evaluated:

Scenario 1: Existing Conditions – Existing volumes obtained from recent traffic counts (February 2015) and the roadway system configuration as of December 2015.

Scenario 2: Cumulative No Project Conditions – Projected traffic volumes and the projected roadway system using the San Mateo City/County Association of Governments Travel Demand Model. The traffic forecasts include buildout of land uses consistent with the existing General Plan and the Ravenswood/4 Corners TOD Specific Plan, in addition to traffic increases due to regional growth. Planned roadway system changes specified in the Ravenswood/4 Corners TOD Specific Plan, such as completion of the Loop Road from Demeter Street to University Avenue, are assumed.

Scenario 3: Cumulative with Project Conditions – Traffic volumes from Scenario 2 plus changes due to development of the Project.

1.5 ANALYSIS METHODS

This section presents the methods used to determine the Project's impacts on motor vehicle traffic flow, and on bicycle, pedestrian, and transit facilities and services, on thoroughfares in the vicinity of the Study Area.

Motor Vehicle Traffic Flow

In California, transportation engineers commonly describe the operations of roadways, with respect to motor vehicle traffic delays, using the concept of "automobile level of service" (a.k.a. "level of service" or LOS). LOS is a qualitative description of motor vehicle traffic flow based on factors such as motor vehicle speeds, travel times, and levels of delay at intersections. Transportation engineers describe six levels of service ranging from LOS A (i.e., best operating conditions for motor vehicles) to LOS F (worst operating conditions for motor vehicles). Intersection levels of service for motor vehicles are based on the average amount of delay experienced by drivers traveling through the intersection. As described below, different methods are used to assess signalized and unsignalized (stop-controlled) intersections.

The traffic study area spans the jurisdictions of three different agencies (the City of East Palo Alto, the City of Menlo Park, and C/CAG). Therefore, the levels of service for each intersection included in the study were evaluated in accordance with the standards set forth by the agency (or agencies) with jurisdiction over that particular intersection. However, the criteria used to determine significant impacts on intersections are primarily based on the level of service standards of the Cities of East Palo Alto and Menlo Park because the standards of the cities are more stringent than the C/CAG standards. These criteria are detailed in Section 1.6, Significant Criteria.

Both signalized and unsignalized intersections were evaluated using methods set forth in the Transportation Research Board's 2000 *Highway Capacity Manual*. These methods are approved for traffic level of service analyses by C/CAG, as described in the 2015 Congestion Management Program (CMP). The study intersections were analyzed for level of service using Synchro Version 9 traffic analysis software.

Signalized Intersections

Peak hour levels of motor vehicle delay at signalized intersections were estimated using the method from Chapter 16 of the Transportation Research Board's 2000 *Highway Capacity Manual*. This operations analysis method uses various intersection characteristics (such as traffic volumes, lane geometry, and signal phasing) to estimate the average control delay experienced by motorists traveling through an intersection. Control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. Table 3 summarizes the relationship between average control delay per vehicle and LOS for signalized intersections.

Unsignalized Intersections

Peak hour levels of motor vehicle delay at unsignalized intersections were estimated using the method from Chapter 17 of the 2000 *Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At two-way or side-street controlled intersections, the control delay (and LOS) is calculated for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. Table 4 summarizes the relationship between average control delay per vehicle and LOS for unsignalized intersections.

Roadway Segment Analysis

Motor vehicle traffic flow was also evaluated by assessing motor vehicle volume-to-capacity (V/C) ratios on several roadway study segments. V/C ratios were calculated based on existing or future average daily traffic (ADT) volumes and daily capacity values for various types of roadways. A level of service scale was used to evaluate roadway performance based on these V/C ratios. These levels range from "A" to "F", with LOS A representing free flow conditions and LOS F representing congested conditions. Descriptions of traffic flow for the different levels of service are provided in Table 5, Standards for Roadway Levels of Service.

Bicycle, Pedestrian & Transit Facilities & Services

Project impacts on bicycle, pedestrian and transit facilities and services were determined on the basis of engineering judgment. To conduct this evaluation, the significance criteria for bicycle, pedestrian and transit impacts established by applicable policies, regulations, goals, and guidelines of the City of East Palo Alto, the City of Menlo Park, and C/CAG were reviewed. Engineering judgment was then applied to determine the impacts of each scenario, given these significance criteria.

Table 3: Level of Service Definitions for Signalized Intersections

Level of Service	Description	Average Control Delay per Vehicle (Seconds)
A	Signal progression is extremely favorable. Most vehicles arrive during the green phase and do not stop at all. Short cycle lengths may also contribute to the very low vehicle delay.	10.0 or less
B	Operations characterized by good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average vehicle delay.	10.1 to 20.0
C	Higher delays may result from fair signal progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.	20.1 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable signal progression, long cycle lengths, or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	This is considered by most drivers to be the limit of acceptable delay. These high delay values generally indicate poor signal progression, long cycle lengths, and high volume-to-capacity (V/C) ratios. Individual cycle failures occur frequently.	55.1 to 80.0
F	This level of delay is considered unacceptable by most drivers. This condition often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes of such delay levels.	Greater than 80.0

Source: Transportation Research Board, 2000 Highway Capacity Manual (Washington, DC, 2000).

Table 4: Level of Service Definitions for Unsignalized Intersections

Level of Service	Description	Average Control Delay per Vehicle (Seconds)
A	Little or no traffic delay	10.0 or less
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	Extreme traffic delays	Greater than 50.0

Source: Transportation Research Board, 2000 Highway Capacity Manual (Washington, DC, 2000).

Table 5: Standards for Roadway Levels of Service

LOS	Traffic Conditions	V/C Value
A	Primarily free flow operations at average travel speeds usually about 90% of free-flow speed. Vehicles can maneuver unimpeded within the traffic stream. Delay at signalized intersections is minimal.	0.00 - 0.60
B	Reasonably unimpeded operations at average travel speeds usually about 70% of free flow speed. Ability to maneuver is only slightly restricted and stopped delays are not bothersome. Drivers are not subjected to appreciable tension.	0.61 - 0.70
C	Represents stable operations, however, ability to maneuver and change lanes in midblock locations may be more restricted. Longer queues and/or adverse signal coordination may contribute to lower average travel speeds of about 50% of free-flow speed. Drivers will experience some appreciable tension.	0.71 - 0.80
D	Borders on a range in which small increases in flow may cause substantial increases in approach delay, and hence, decreases in arterial speed. Causes range from adverse signal progression, inappropriate signal timing, high volumes, or any combination. For planning purposes, this Level of Service is the lowest that is considered acceptable. Average travel speeds are about 40% of free-flow speed.	0.81 - 0.90
E	Characterized by significant approach delays and average travel speeds of one-third of free-flow speed or lower, caused by adverse progression, high signal density, extensive queuing at critical intersections, inappropriate signal timing, or some combination.	0.91 - 1.00
F	Characterized by arterial flow at extremely low speeds below one-third to one-quarter of free flow speed. Congestion is likely at critical signalized intersections, resulting in high approach delays. Adverse progression is frequently a contributor to this situation.	Above 1.00

Source: 1999 East Palo Alto General Plan Circulation Element, Table C-2

1.6 SIGNIFICANCE CRITERIA

The determination of significance for project transportation impacts is based on applicable policies, regulations, goals, and guidelines defined by the City of East Palo Alto, the City/County Association of Governments of San Mateo County (C/CAG), and state law. To evaluate the transportation impacts of the Project, each analysis scenario (Existing Conditions, Cumulative without Project Conditions, and Cumulative with Project Conditions) was evaluated to estimate its impacts on automobile delays and bicycle, pedestrian, and transit facilities and services. The detailed transportation impact criteria used to conduct this evaluation are presented below.

Automobile Delay Criteria

To define what constitutes a significant impact regarding motor vehicle delays, this study uses the automobile level of service (LOS) criteria adopted by the Cities of the East Palo Alto and Menlo Park, and by C/CAG.

East Palo Alto's Automobile Level of Service Criteria

The City of East Palo Alto assesses motor vehicle delays using a level of service standard of LOS D for intersections. Specifically, a significant automobile delay impact under this LOS D standard would be considered to occur at an intersection if for any peak hour the Project would result in any of the following:

- At a signalized intersection, an impact is considered significant if it:
  - Causes operations to degrade from LOS D (or better) to LOS E or F; or
  - Exacerbates LOS E or F conditions by both increasing critical movement delay by four or more seconds and increasing volume-to-capacity ratio (V/C ratio) by 0.01; or
  - Increases the V/C ratio by > 0.01 at an intersection that exhibits unacceptable operations, even if the calculated LOS is acceptable.
- At an unsignalized intersection, an impact is considered significant if it:
  - Causes operations to degrade from LOS D or better to LOS E or F; or
  - Exacerbates LOS E or F conditions by increasing control delay by five or more seconds; and
  - Causes volumes under project conditions to exceed the Caltrans Peak Hour Volume Warrant Criteria.

East Palo Alto's 1999 General Plan also evaluated automobile level of service by calculating volume-to-capacity (V/C) ratios based on existing or future average daily traffic (ADT) volumes and daily capacity values for various types of roadways.[5] Table 6 provides the daily capacity values specified in the 1999 General Plan for calculating roadway V/C ratios. The 1999 General Plan notes that due to the generalized nature of ADT capacities, the values are typically viewed as general rather than absolute guides for estimating level of service and sizing the future roadway system.[6] The City of East Palo Alto's performance criteria for evaluating automobile level of service on the City's roadways using this ADT-based approach is LOS D. Using this approach, on a roadway segment, an impact is considered significant if it causes operations to degrade from LOS D or better to LOS E or F.

Table 6 Average Daily Traffic (ADT) Capacities by Roadway Type

Type of Roadway	ADT Capacity
4 Lane Divided Roadway	37,500
4 Lane Undivided Roadway	25,000
2 Lane Undivided Roadway	12,500

Source: 1999 East Palo Alto General Plan Circulation Element, Table C-3

[5] 1999 East Palo Alto General Plan Circulation Element, p. 11-14.

[6] Ibid, p. 14.

Menlo Park's Automobile Level of Service Criteria

Three of the study intersections are located within the City of Menlo Park. All three are signalized intersections and are located on state routes. The City of Menlo Park has established distinct significance criteria for signalized intersections based on the category of the intersecting streets.

For signalized intersections involving a state route and a city-controlled street (Willow Road [State Route 114]/Newbridge Street), the Project is said to create a significant impact if for any peak hour:

- The level of service degrades from an acceptable LOS D or better under existing conditions to an unacceptable LOS E or F under existing with project conditions, or the average delay per vehicle increases by more than 23 seconds per vehicle, or
- The level of service is an unacceptable LOS E or F under existing conditions and the addition of project trips causes an increase of more than 0.8 seconds of average delay to vehicles on the critical movement for any local approach.

For signalized intersections involving two state routes (Bayfront Expressway [State Route 84]/ Willow Road [State Route 114], and Bayfront Expressway [State Route 84]/University Avenue [State Route 109]), the Project is said to create a significant impact if for any peak hour:

- The level of service degrades from an acceptable LOS D or better under existing conditions to an unacceptable LOS E or F under existing with project conditions, or the average delay per vehicle increases by more than 23 seconds per vehicle, or
- The level of service is an unacceptable LOS E or F under existing conditions and the addition of project trips causes an increase in the average control delay at the intersection by four seconds or more.

C/CAG's Automobile Level of Service Criteria

A significant automobile delay impact would also be considered to occur if the Project would conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the County Congestion Management Agency for designated roads and highways. In San Mateo County a project is considered to have a CMP impact if it causes one or more of the following:

1. **CMP Intersection currently in compliance with the adopted LOS standard:**
   a. A project will be considered to have a CMP impact if the project will cause the CMP intersection to operate at a level of service that violates the standard adopted in the current Congestion Management Program (CMP).
   b. A project will be considered to have a CMP impact if the cumulative analysis indicates that the combination of the proposed project and future cumulative traffic demand will result in the CMP intersection to operate at a level of service that violates the standard adopted in the current Congestion Management Program (CMP) and the proposed project increases average control delay at the intersection by four (4) seconds or more.
2. **CMP Intersection currently not in compliance with the adopted LOS standard:** A project is considered to have a CMP impact if the project will add any additional traffic to the CMP intersection that is currently not in compliance with its adopted level of service standard as established in the CMP.

Three of the signalized study intersections are included in or located on the CMP roadway system (Willow Road/Newbridge Street, Willow Road/Bayfront Expressway, and University Avenue/Bayfront Expressway). The CMP level of service standard for these intersections is LOS E or F. Since these thresholds are less stringent than the standard set forth by the local jurisdiction (the City of Menlo Park), the City of Menlo Park's standards were used to evaluate these intersections.

Pedestrian and Bicycle Impact Criteria

The *City of East Palo Alto 1999 General Plan* describes policies necessary to ensure that pedestrian and bicycle facilities are safe and effective for City residents. Generally, significant impacts to these facilities would occur if a project or an element of a project:

- Creates a hazardous condition that currently does not exist for pedestrians and bicyclists, or otherwise interferes with pedestrian accessibility to the study area and adjoining areas; or
- Conflicts with an existing or planned pedestrian or bicycle facility; or
- Conflicts with policies related to bicycle and pedestrian activity adopted by the City of East Palo Alto.

Transit Impact Criteria

Generally, a project causes a significant impact to transit facilities and services if an element of it conflicts with existing or planned transit services. The evaluation of transit facilities shall consider if:

- A project creates demand for public transit services above the capacity which is provided or planned;
- A project or project-related mitigation disrupts existing transit services or facilities[7];
- A project or project-related mitigation conflicts with existing or planned transit facility; or
- A project or project-related mitigation conflicts with transit policies adopted by the City of East Palo Alto, SamTrans, or ACTC for their respective facilities in the study area.

[7] This includes disruptions caused by proposed project streets or driveways on transit streets and impacts to transit stops/shelters; and impacts to transit operations from roadway changes proposed or resulting from a project.

2 EXISTING CONDITIONS

This chapter describes existing transportation conditions in the Project study area (i.e., the City of East Palo Alto). This chapter was informed by a data collection effort led by Nelson\Nygaard, which included both traffic counts and site visits. This assessment of existing conditions includes a description of the street and highway system, bicycle and pedestrian facilities, and public transit facilities and services in and near the study area. It also presents existing traffic volumes and describes operating conditions for the study intersections, including providing the results of automobile level of service calculations.

2.1 EXISTING TRANSPORTATION FACILITIES

Existing Roadway Network

This section describes the existing streets and highways in the study area, as well as key surrounding roadways. Regional access to the Plan Area is primarily provided via U.S. Highway 101 and the Bayfront Expressway (State Route 84) to the north of the city limits. These facilities are described below:

- **U.S. Highway 101 (Highway 101)** is a north-south freeway that connects San Mateo County with San Francisco County to the north and Santa Clara County to the south. Within the Plan Area, Highway 101 is three travel lanes, one HOV lane, and one auxiliary lane between access ramps in each direction. Three full-access interchanges, at University Avenue, Willow Road, and Embarcadero Road, provide access from Highway 101 to East Palo Alto.
- **Bayfront Expressway (State Route 84)** is a four-lane east-west expressway located directly to the north of the study area. It extends from Highway 101 East eastwards, connecting Menlo Park and East Palo Alto with the City of Newark and Interstate 880 in the East Bay via the Dumbarton Bridge.

Other major roadways within East Palo Alto are described below:

- **Bay Road** is a two to four lane east-west collector street that originates at East Bayshore Road and extends eastward towards the San Francisco Bay where it terminates at Cooley Landing. Between University Avenue and Pulgas Avenue, Bay Road is primarily two travel lanes in each direction with on-street parking. Between University Avenue and Newbridge Street, Bay Road is one travel lane in each direction with a two-way left turn lane. East of Pulgas Avenue and west of Newbridge Street, Bay Road is an undivided two-lane roadway.
- **Clarke Avenue** is a two-lane north-south collector street with on-street parking on both sides extending from East Bayshore Road in the south to Bay Road in the north, where it changes designation to Illinois Street.
- **Cooley Avenue** is a two-lane north-south local street with on-street parking on both sides extending from Donohoe Street in the south to University Avenue in the north.
- **Donohoe Street** is an east-west divided street with two travel lanes and on-street parking in each direction. The street extends from E. Bayshore Road in the west to Clarke Avenue in the east.

- **East Bayshore Road** is a north-south frontage road located directly north of Highway 101. The road originates in the City of Palo Alto, spanning the length of much of East Palo Alto before changing designation to Saratoga Avenue at Bay Road. It is primarily one travel lane in each direction, with two travel lanes in each direction separated by a central median between University Avenue and Clarke Avenue.
- **Euclid Avenue** is a north-south local street with one travel lane and on-street parking in each direction. The street extends from East Bayshore Road in the south to Runnymede Street in the north.
- **Pulgas Avenue** is a north-south collector street with one travel lane in each direction and on-street parking. The street extends from East Bayshore Road in the south to just north of Bay Road where it terminates as a dead end.
- **Runnymede Street** is an east-west local street with one travel and on-street parking in each direction. The street extends from Palo Verde Avenue in the west towards the San Francisco Bay and Bay Trail where it terminates just east of Pulgas Avenue.
- **University Avenue (State Route 109)** is a north-south arterial that extends from the Stanford University campus in the City of Palo Alto to the Bayfront Expressway directly north of the City of East Palo Alto where it terminates. Within East Palo Alto, University Avenue is primarily two travel lanes in each direction divided by a central median.
- **Willow Road (State Route 114)** is a north-south divided arterial with two travel lanes in each direction. In some sections, Willow Road delineates the northernmost border between Menlo Park and East Palo Alto. Most of the roadway is within Menlo Park city limits, but a small segment (adjacent to U.S. Highway 101) passes through the westernmost corner of East Palo Alto. The road begins in the City of Menlo Park at Alma Street and extends northwards through Menlo Park to Bayfront Expressway.

Existing Pedestrian Facilities

The pedestrian network includes sidewalks, pathways, crosswalks, and pedestrian signals. Numerous streets in East Palo Alto lack sidewalks on either one or both sides. Some East Palo Alto streets, such as those in the Gardens Neighborhood, are slender and have rolled curbs, which frequently results in drivers parking on sidewalks. Wheelchair users and other pedestrians are then forced to walk in the street. Key barriers, such as Highway 101 and San Francisquito Creek, also limit pedestrian travel. In particular, the barrier created by U.S. Highway 101, and the lack of adequate bicycle and pedestrian crossing accommodations on the University Avenue (State Highway 109) and Willow Road (State Highway 114) overpasses, limit connectivity. Figure 2 shows the existing and proposed pedestrian network for East Palo Alto. This map also identifies roadway segments in and around the plan area that currently lack sidewalks.

Existing Bicycle Facilities

East Palo Alto's existing bicycle facilities are divided into three classes. Class I bikeways are bike paths that are physically separated from motor vehicles and offer two-way bicycle travel on a separate path. Class II bikeways are striped bicycle lanes on roadways that are marked by signage and pavement markings. Class III bikeways are bicycle routes designated only with signs to help guide bicyclists on recommended routes. Figure 3 shows the existing and proposed bicycle network for East Palo Alto.

In and near the study area, bicycle lanes exist on:

- University Avenue, south of Highway 101, between Donohoe Street and O'Brien Drive, and between Adams Drive and Bayfront Expressway

- Bay Road, between Ralmar Avenue and Pulgas Avenue
- O'Connor street, between Clark Avenue and Pulgas Avenue
- Willow Road, between Newbridge street and Bayfront Expressway

Just north of the study area a bicycle path runs adjacent to Bayfront Expressway. The Bay Trail connects the eastern terminus of Weeks Street to Geng Road and Embarcadero Road in Palo Alto.

On other roadways in and around the study area, cyclists share the road with automobile traffic.

The City's existing bicycle network is relatively modest, even though the bicycle mode share in the City is four times the countywide average (4% versus 1%). Existing facilities do afford both north-south and east-west bicycle connectivity, but key facility gaps exist. The bicycle lanes on Bay Road, Willow Road, and University Avenue are not continuous, but have gaps in the sections where these roadways cross Highway 101. Other than a bicycle bridge located in Palo Alto, to the south of the study area, there are no bicycle facilities available for crossing Highway 101.

Existing Transit Facilities & Services

There are currently frequent transit options throughout much of East Palo Alto. Transit service in the study area is primarily provided by SamTrans. Most commute hour bus lines serving East Palo Alto operate on 15 minute headways, thus requiring short waits between buses. Paratransit service in the study area is provided by Redi-Wheels. AC Transit's Dumbarton Express buses also pass through the study area, as does the currently disused Dumbarton Rail Corridor.

Figure 4 shows existing and planned transit service in the study area.

Five **SamTrans** routes have stops within East Palo Alto City limits, including:

- **Route 280** with service to the Stanford Shopping Center, Palo Alto Caltrain Station, and the Ravenswood Shopping Center (one hour headways)
- **Route 281** with service to the Stanford Shopping Center, Palo Alto Caltrain Station, East Palo Alto, and the Onetta Harris Community Center (15 minute peak headways)
- **Route 296** with service to Redwood City, Atherton, and Menlo Park (15 minute peak headways)
- **Route 297** with service to Redwood City and Palo Alto
- **Route 397** with late night service to San Francisco, South San Francisco, San Francisco International Airport, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, and Palo Alto

SamTrans is also currently studying ways of restructuring bus service in East Palo Alto, particularly as new development projects are completed.

AC Transit operates two **Dumbarton Express** routes which do not stop in East Palo Alto, but offer connections between the city of Menlo Park and the East Bay (including the Union City BART station), as well as Palo Alto and Stanford University. Both routes only operate during peak commute hours.

The **Dumbarton Rail Corridor**, which is currently disused, is owned by the San Mateo County Transit District. Currently, the San Mateo County Transportation Authority is considering restoring train service or establishing bus rapid transit service on a 4.5-mile segment of the Dumbarton Rail Corridor between the Redwood City Caltrain Station and Willow Road in Menlo Park, near Facebook's campus.

Figure 2: Existing & Proposed Pedestrian Network

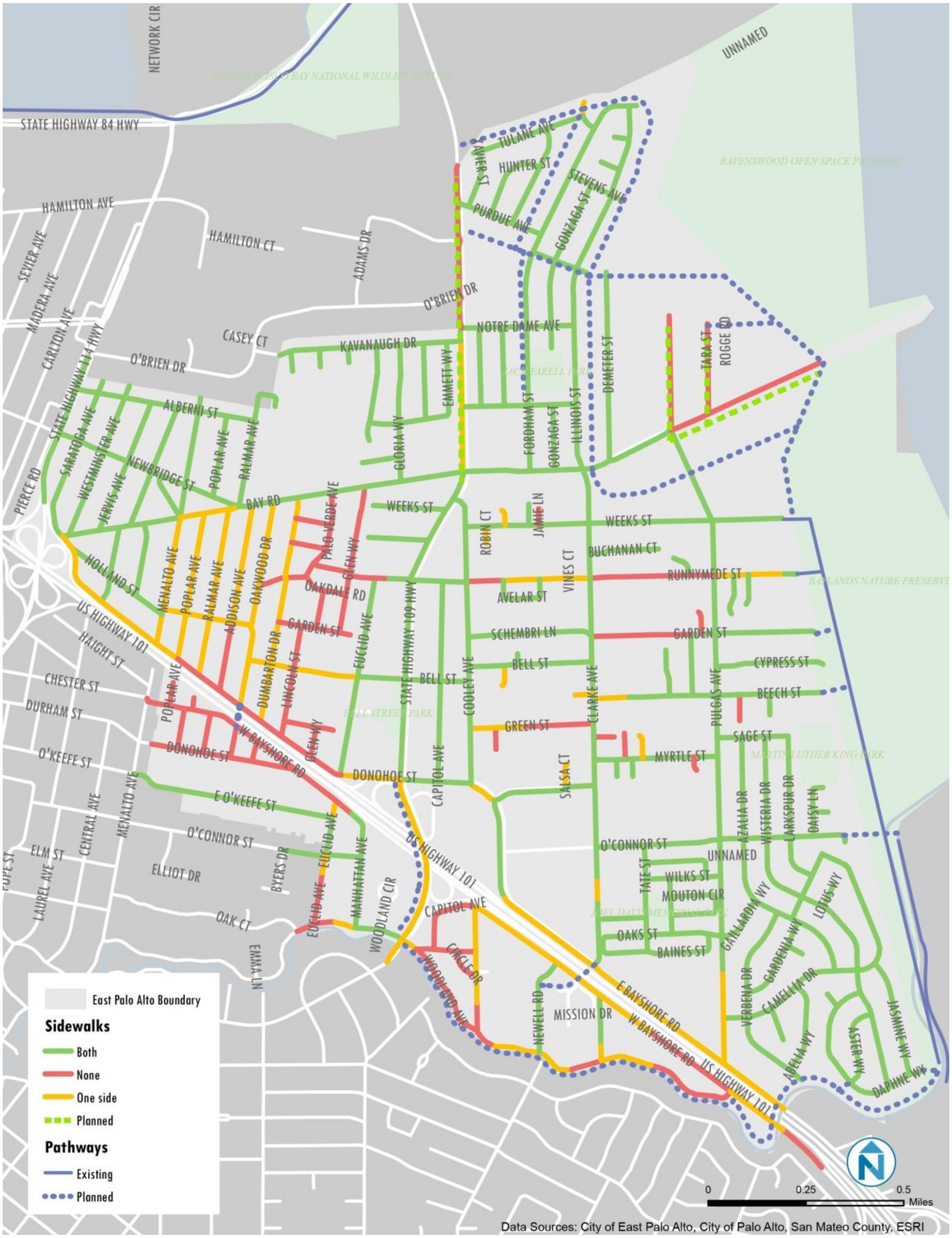


Figure 3: Existing & Proposed Bicycle Network

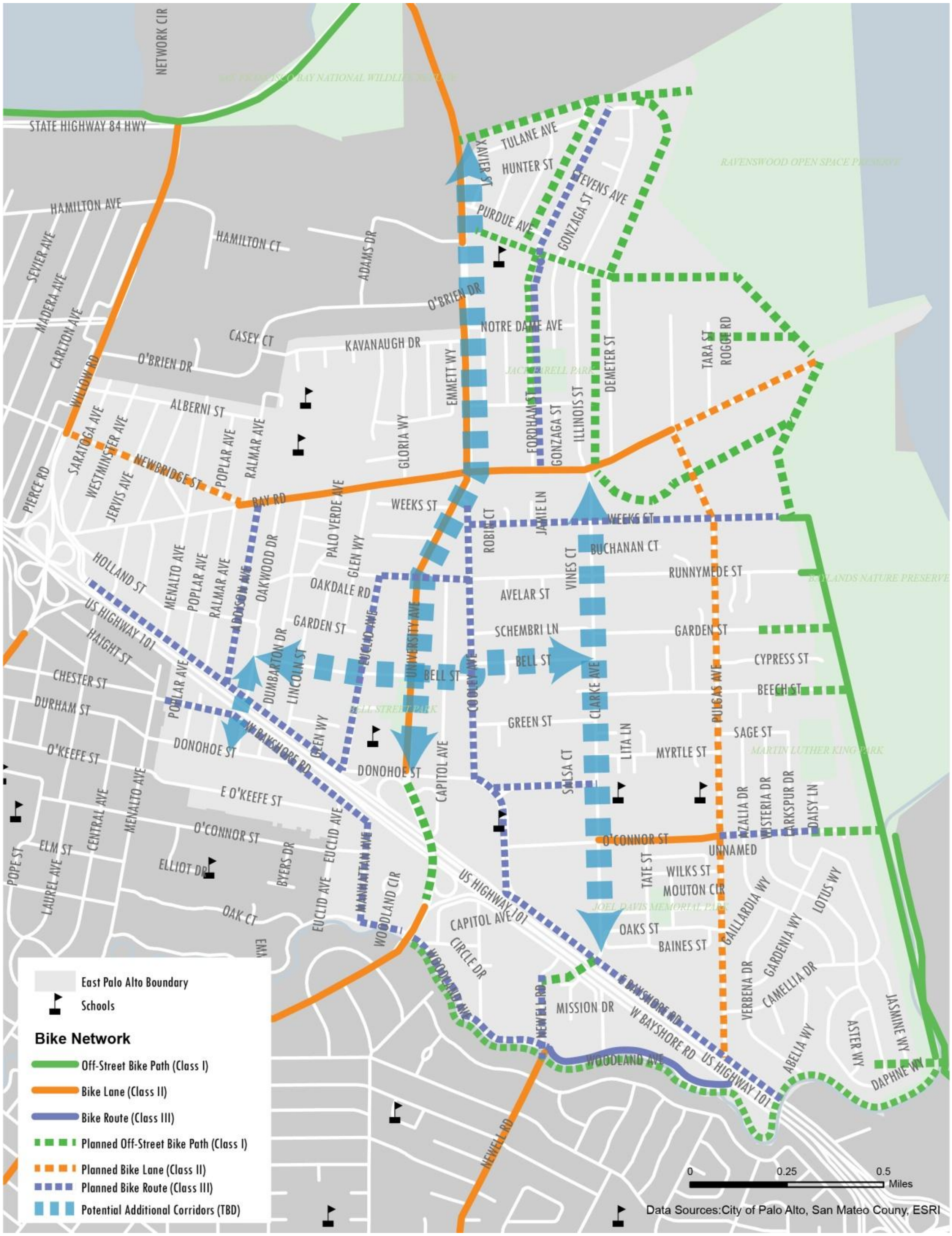


Figure 4: Existing & Proposed Transit Service

The proximity of high capacity transit service, however, such as Caltrain, bus service along El Camino Real, and the proposed high-capacity transit (rail or bus rapid transit) service along the Dumbarton Corridor, presents an opportunity to improve connectivity between East Palo Alto and regional employment and activity centers.

Caltrain provides commuter rail service between San Francisco and Gilroy. The study area is about four miles northeast of the Palo Alto Caltrain station in downtown Palo Alto. At the Palo Alto station, Caltrain provides service with approximately 15 to 30 minute headways during the weekday commute hours.

2.2 EXISTING TRAFFIC VOLUMES AND LANE GEOMETRIES

This section describes the results of the intersection turning movement counts and roadway segment counts conducted to obtain the traffic volume data required for the study, as well as the lane configurations and traffic controls observed at the study intersections.

Weekday morning (7:00am to 9:00am) and evening (4:00pm to 6:00pm) peak period intersection turning movement counts were conducted at the study intersections in February 2015. The counts were conducted on a typical weekday to reflect the normal operation of the intersections during these times. Existing lane configurations and traffic controls at each intersection were determined through field observations. In addition, 24-hour average daily traffic counts were taken on 10 roadway segments. These counts were conducted for 24 hours on a typical weekday (with one additional count conducted for Donohoe Street on a Saturday). Figure 5 shows the existing lane configuration and traffic controls at each of the study intersections. Figure 6 and Figure 7 show the individual intersection turning movement counts at the study intersections for the AM and PM peak periods, respectively. The supplemental 24-hour traffic counts for the selected segments are presented in Table 7 and Figure 8.

Table 7: Existing Average Daily Traffic Volumes

Street Segment	Volume (2-Way ADT)
Bay Rd between Gloria Way & University Ave	8,410
University Ave between Michigan Ave & Bay Rd	25,610
Runnymede St between Cooley Ave & Clarke Ave	3,410
Euclid Ave between Bell Street Park Pl & Donohoe St	3,498
Clarke Ave between Donohoe St & O'Connor St	7,231
Pulgas Ave between Myrtle St and O'Connor St	7,137
Donohoe St between University Ave & Capitol Ave	Thursday – 34,120
	Saturday – 32,703
E. Bayshore Rd between Glen Way & Euclid Ave	10,218
E. Bayshore Rd between Clarke Ave & Pulgas Ave	9,444
W. Bayshore Rd between Cooley Ave & Newell Rd	4,780

Figure 5: Existing Intersection Lane Configurations

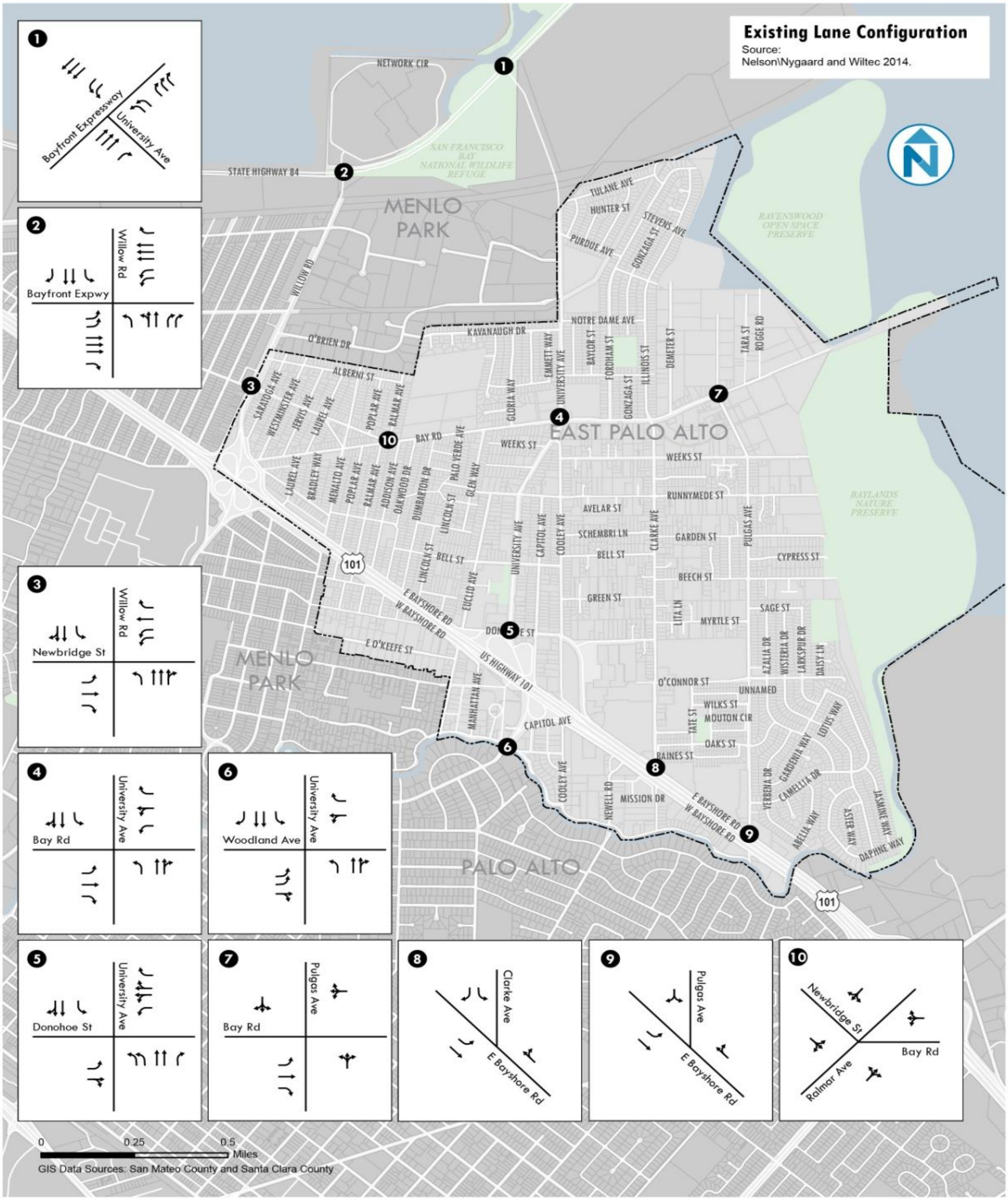


Figure 6: Existing A.M. Peak Hour Traffic Volumes

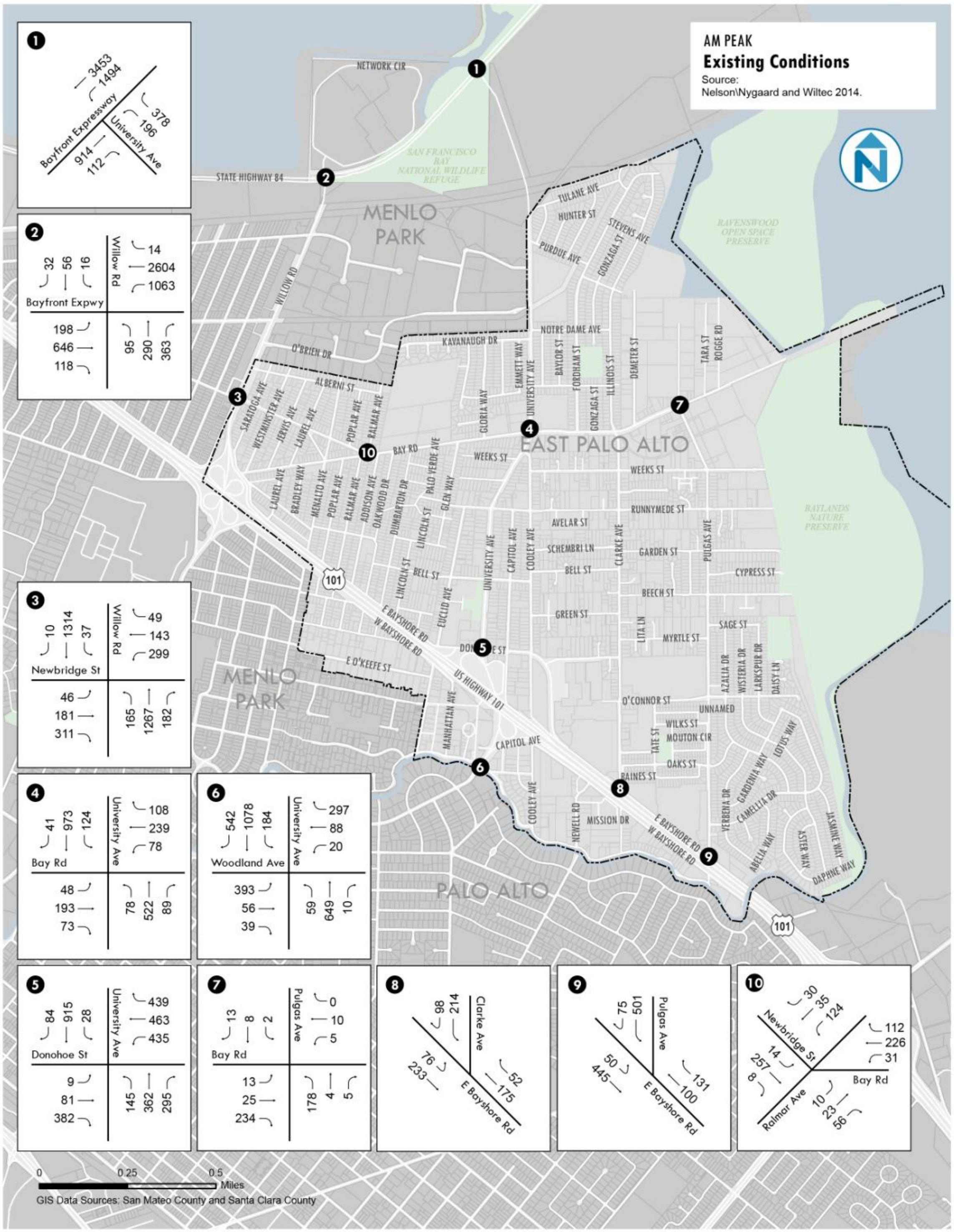


Figure 7: Existing P.M. Peak Hour Traffic Volumes

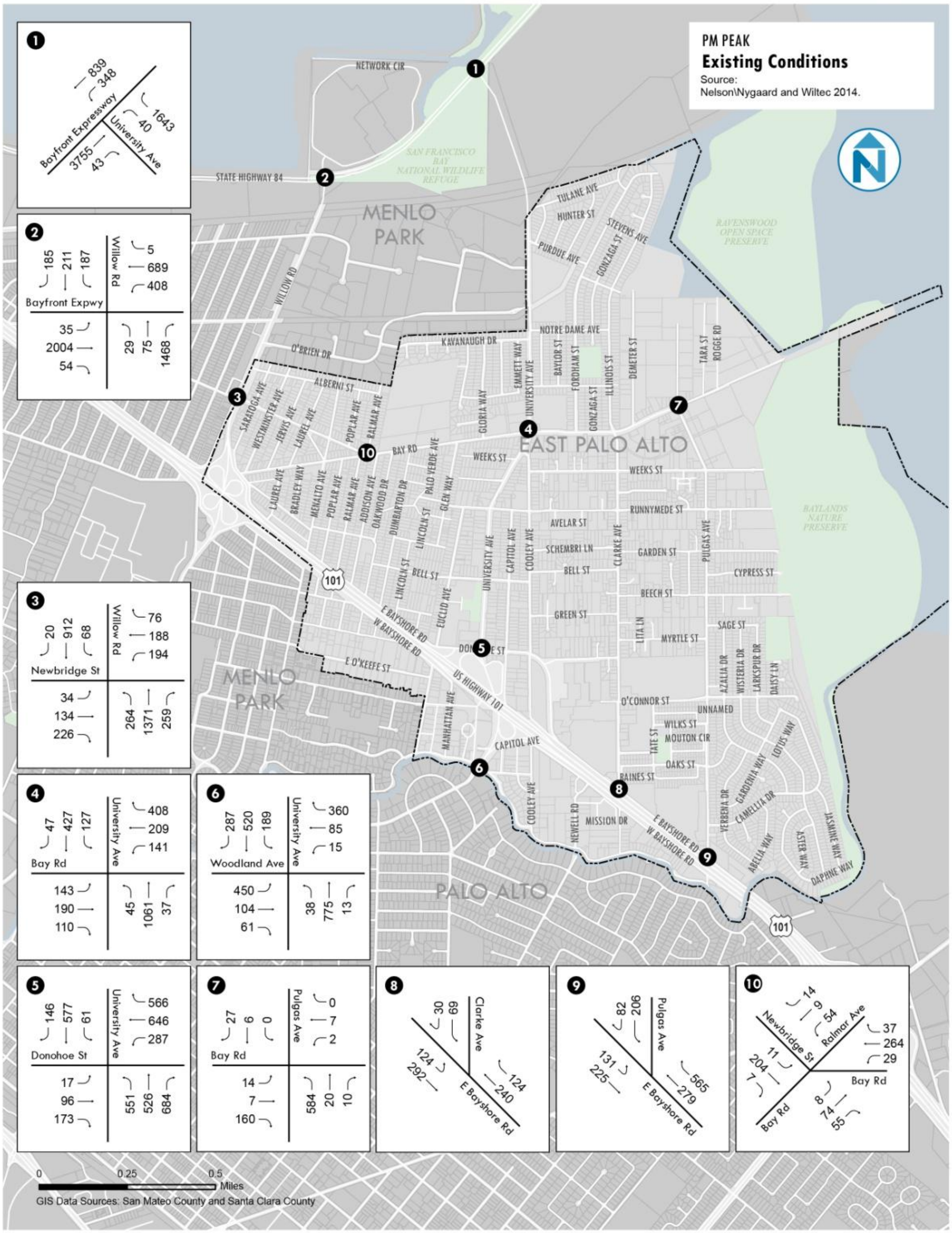


Figure 8: Existing Average Daily Traffic Volumes

East Palo Alto Average Daily Traffic

2.3 EXISTING INTERSECTION LEVELS OF SERVICE

Existing intersection lane configurations, signal timings, and peak hour turning movement volumes were used to calculate the levels of service for the key intersections during each peak hour. The LOS analysis was conducted using Synchro Version 9 traffic analysis software. The results of the analysis are presented in Table 8. The table presents the level of service (LOS) standard for each intersection, the calculated LOS of each intersection for both the AM and PM peak periods, and the average intersection delay. Appendix A contains the corresponding LOS calculation sheets.

The results of the LOS calculations indicate that the following study intersections do not meet their designated LOS standards during at least one peak hour:

- University Avenue and Bayfront Expressway, in Menlo Park (PM)
- Willow Road and Bayfront Expressway, in Menlo Park (PM)
- University Avenue and Donohoe Street, in East Palo Alto (AM and PM)
- East Bayshore Road and Pulgas Avenue, in East Palo Alto (PM)

Table 8: Existing Peak Hour Intersection Levels of Service

Intersection	LOS Standard	AM Peak Hour		PM Peak Hour	
		LOS	Avg Delay (seconds)	LOS	Avg Delay (seconds)
1. University Ave & Bayfront Expressway	D	B	19	**F**	**157**
2. Willow Rd & Bayfront Expressway	D	C	28	**F**	**99**
3. Willow Rd & Newbridge St	D	C	33	C	31
4. University Ave & Bay St	D	D	37	D	40
5. University Ave & Donohoe St	D	**E**	**77**	**F**	**121**
6. University Ave & Woodland Ave	D	D	40	D	39
7. Bay Rd & Pulgas Ave (all way stop)	D	A	5	C	18
8. E. Bayshore Rd & Clarke Ave	D	B	12	B	10
9. E. Bayshore Rd & Pulgas Ave	D	B	18	**E**	**70**
10. Bay Rd & Newbridge St (all way stop)	D	C	16	B	12

The study intersections on Bayfront Expressway at University Avenue and at Willow Road operate at LOS F during the PM peak hour. While the intersections meet the CMP level of service standard (LOS F), they do not meet the City of Menlo Park's standard (LOS D). The intersection of University Avenue and Donohoe Street operates at LOS E during the AM peak hour and LOS F during the PM peak hour, and the intersection of East Bayshore Road and Pulgas Avenue operates at LOS E during the PM peak hour. These intersections do not meet the City of East Palo Alto's standard (LOS D). The remaining study intersections currently operate at acceptable levels of service, according to the respective level of service standards of each jurisdiction.

3 PROJECT CHARACTERISTICS

This chapter summarizes the land use characteristics of the proposed East Palo Alto General Plan Update (the Project) and describes the changes in motor vehicle trips that are projected to result from the Project. This chapter also describes the projected distribution of those motor vehicle trips, and how they were assigned to the roadway network. The changes in motor vehicle traffic associated with the project were estimated using a three-step process:

1. **Trip Generation** – The *amount* of vehicle traffic resulting from the Project was estimated.
2. **Trip Distribution** – The *directions* that these vehicle trips would travel when approaching and departing the Project's land uses was projected.
3. **Trip Assignment** – These trips were then *assigned* to specific roadway segments and intersection turning movements.

3.1 PROJECT DESCRIPTION

The City of East Palo Alto is located in San Mateo County, California, adjacent to San Francisco Bay and the cities of Menlo Park and Palo Alto. The proposed East Palo Alto General Plan Update is the result of an extensive public process undertaken to provide guidance on future development in the City. The General Plan is a 20-year planning document that assigns land use policy and associated densities and intensities to all properties within the project area. In East Palo Alto, infill development represents the primary avenue for growth. Most of East Palo Alto is built out (at lower than permitted densities) and will not realistically redevelop over the life of the plan, and maximum buildout city wide would grossly overestimate and unrealistically overstate future impacts.

The General Plan Update development scenario does not assume the full buildout of the plan area—the theoretical amount of development that would occur if every parcel in the plan area were rebuilt to the new maximum allowable density and intensity set forth in the General Plan Updated—because a number of limiting factors reduce the feasibility of the realization of theoretical buildout scenario. These factors include the existing urban context, policies and programs that limit new growth, setting forth a development limit, and the existing regulatory environment. As such, the City has assumed that not every property in the City and plan area would be developed at the maximum residential densities or non-residential intensities allowed by the General Plan Update.

With few exceptions, the City notes that most remaining opportunity sites (vacant or underutilized), which the City reasonably considers to be those most likely to be developed or redeveloped in the future, are relatively small and located within densely inhabited areas.

Table 9 below summarizes expected growth by district and land use type under the General Plan Update. The projected additional residential growth is expected to increase the City's population by approximately 7,500 people.

Table 9 Anticipated Growth under General Plan Update

District/Area	Net New Units	New Retail	Net Office	Net Industrial
Ravenswood/4 Corners Area	835	112,400 sq. ft	1,235,853sq. ft	267,987 sq. ft
Westside (Capped at Existing G.P.)	900	45,000	0	0
2nd units on single-family parcels	119	0	0	0
Other Parcels	665	176,006 sq. ft	704,000 sq. ft	0.
TOTAL	**2,519**	**333,406 sq. ft**	**1,939,853 sq. ft**	**267,987 sq. ft**

Source: Raimi & Associates, 2015.

Future development proposals within the City would be subject to City review for consistency with the General Plan and additional analysis may be required.

3.2 PROJECT TRIP GENERATION

Trip generation refers to the process of estimating the amount of motor vehicle traffic that a project will add to (or subtract from) the surrounding roadway system. Estimates are made of future trips on a daily basis and for the peak one-hour periods during the morning and evening commute periods when traffic volumes on the adjacent streets are highest.

The trip generation estimates for the project, as well the trip distribution and assignment forecasts, were developed using the City/County Association of Governments of San Mateo County's (C/CAG's) countywide travel demand model. California's Congestion Management Program legislation requires that C/CAG, as the Congestion Management Agency for San Mateo County, maintain a countywide travel demand model. The model is used to identify the impacts of land use development and project future transportation conditions resulting from land use changes.

C/CAG licenses the countywide travel demand model for San Mateo County from the Santa Clara Valley Transportation Authority (VTA). The model is optimized for the counties of Santa Clara and San Mateo and accounts for transportation impacts from neighboring counties and regional commute sheds. The C/CAG-VTA Model is a four-step travel demand model implemented in Citilabs Cube Voyager software, and is based on ABAG Plan Bay Area Projections (P2013) used by the Metropolitan Transportation Commission (MTC). More detailed information on the C/CAG-VTA Model is included in the most recently adopted *San Mateo County Congestion Management Program*.

The traffic forecasts for the Project were made using the most recent official version of the C/CAG-VTA model, which is based on ABAG Plan Bay Area Projections (P2013) with 2040 as the cumulative year. The more up-to-date 2040 C/CAG model was used (rather than the old 2035 model) because it provides the most accurate representation of expected future growth patterns in the region.

The C/CAG-VTA Model was reviewed and appropriate adjustments were made to the network and land uses within the East Palo Alto study area to ensure the model was consistent within the City. A minor localized validation check to compare against the February 2015 traffic counts collected for this study was done. Any residual model error was screened out using the incremental adjustment methods set forth in the Transportation Research Board's *NCHRP Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design*. The existing and projected number of households and jobs in the model for 2013 and

2040 for the Traffic Analysis Zones (TAZs) within the City were reviewed by City and appropriate adjustments made so that the model reasonably reflects existing conditions and projected 2040 Cumulative No Project Scenario conditions.

The model was then run with the proposed Project's land use and network assumptions to extract appropriate metrics for evaluation. The model was run for the following scenarios:

- **Scenario 1: Existing Conditions**
- **Scenario 2: Cumulative No Project Conditions** – Projected traffic volumes and the projected roadway system, without the Project. The traffic forecasts include buildout of land uses consistent with the existing General Plan and the (already approved) Ravenswood/4 Corners TOD Specific Plan, in addition to traffic increases due to regional growth. Planned roadway system changes specified in the Ravenswood/4 Corners TOD Specific Plan, such as completion of the planned Loop Road from Demeter Street to University Avenue, are assumed.
- **Scenario 3: Cumulative with Project Conditions** – Traffic volumes and the projected roadway system from Scenario 2 plus changes due to development of the Project.

The model was run to obtain detailed traffic volume estimates for each scenario for the 10 study intersections for the AM and PM peak one-hour periods, as well as average daily traffic volume estimates for the 10 roadway study segments. The forecasts were adjusted using the incremental adjustment methods based on NCHRP Report 255 for further LOS analysis. The outputs for each scenario also included link-level or segment outputs and vehicle miles traveled (VMT) outputs. Depending on the types and sizes of future projects that are actually developed within the Project area under the new General Plan, the actual number of trips generated could be less than the number predicted by the model.

3.3 PROJECT TRIP DISTRIBUTION & ASSIGNMENT

Using the C/CAG-VTA Model (described in more detail in the section above), project trip distribution patterns were developed and the net peak-hour trips generated by the proposed Project were assigned to the roadway system. The project trip assignments for the AM and PM peak periods are presented in Figure 9 and Figure 10, respectively.

Figure 9: Project Trip Assignment, AM Peak Hour

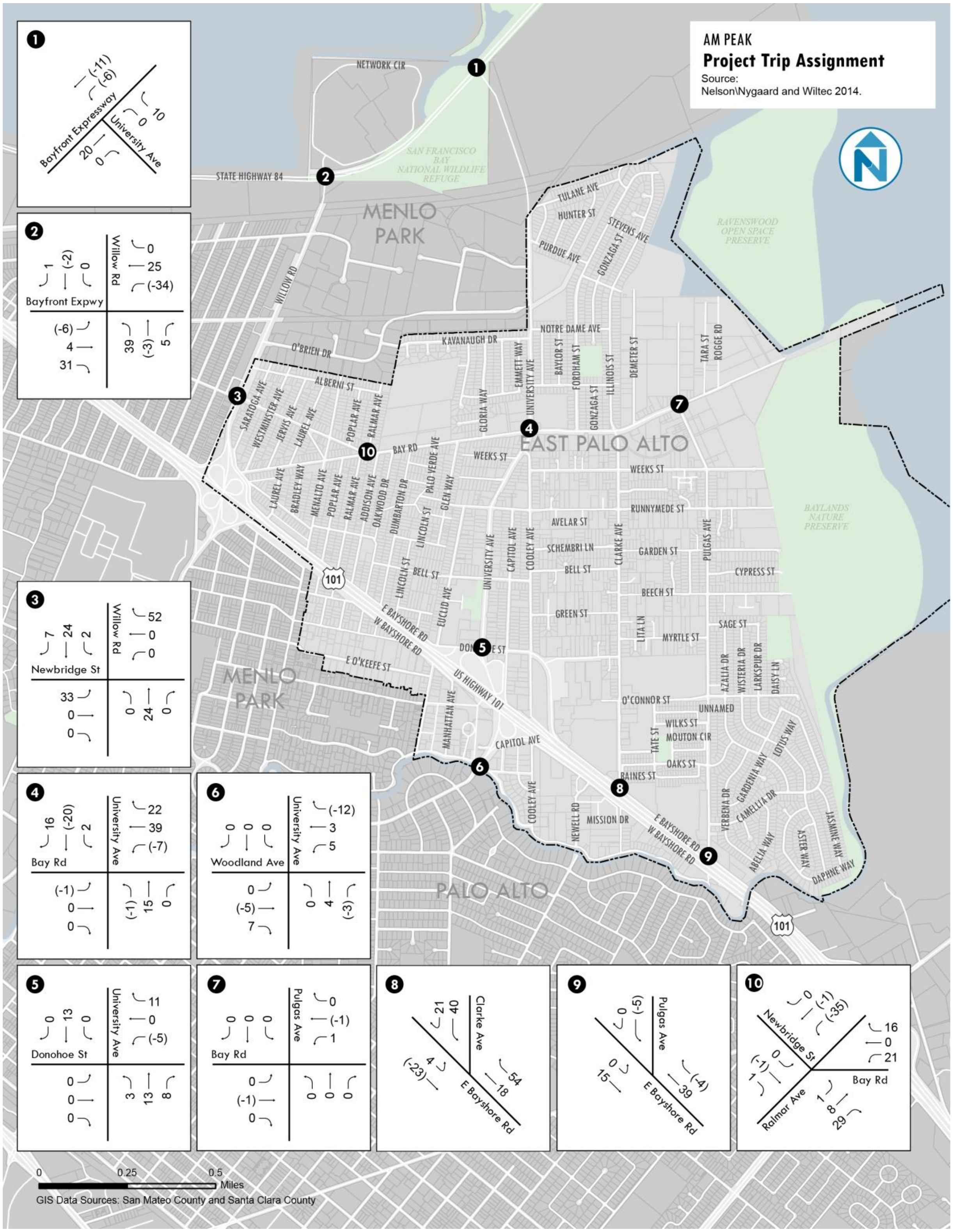
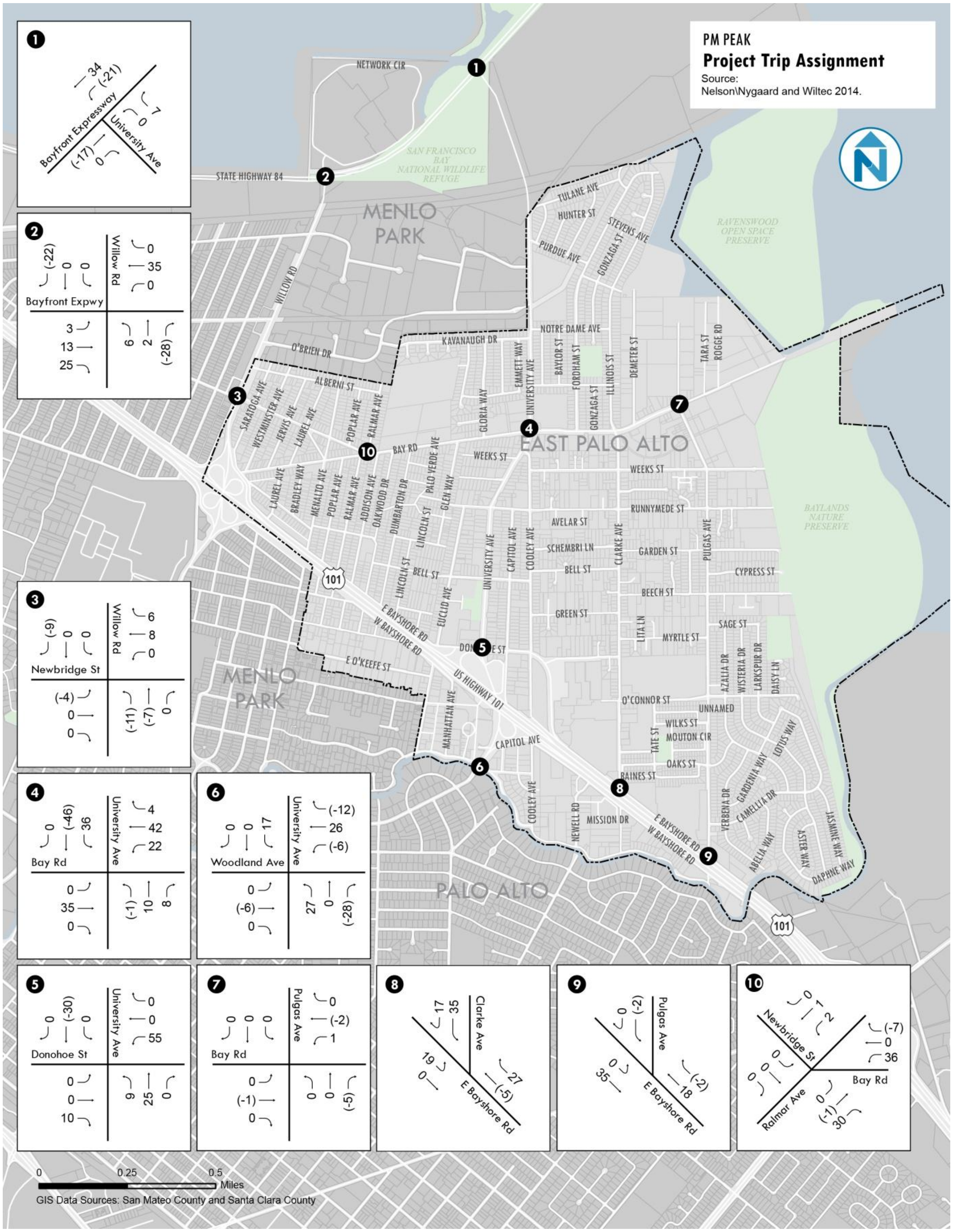


Figure 10: Project Trip Assignment, PM Peak Hour



4 CUMULATIVE CONDITIONS

This chapter describes projected transportation conditions under Cumulative conditions without and with the Project. This includes presenting projected traffic volumes and automobile level of service results for the study intersections and roadway study segments under the Cumulative No Project and Cumulative with Project scenarios. This assessment also describes projected conditions for bicycle facilities, pedestrian facilities, and public transit facilities and services, in and near the study area. Projected transportation conditions in each scenario were evaluated using the methods described in Chapter 1, Section 1.4, Analysis Methodology.

4.1 CUMULATIVE TRAFFIC VOLUMES

Motor vehicle traffic forecasts for the Cumulative No Project and Cumulative with Project scenarios were developed using the City/County Association of Governments of San Mateo County's (C/CAG's) countywide travel demand model. The C/CAG-VTA Model is a four-step travel demand model implemented in Citilabs Cube Voyager software. The model is described in more detail in Chapter 3, Section 3.2, Project Trip Generation. The forecast traffic volumes for the AM and PM peak periods for the Cumulative No Project scenario are presented in Figure 11 and Figure 12, respectively. Net new project trip estimates from Chapter 3 were added to the Cumulative No Project conditions to arrive at traffic volumes for the Cumulative with Project scenario. The forecast traffic volumes for the AM and PM peak periods for the Cumulative with Project scenario are presented in Figure 13 and Figure 14, respectively.

4.2 CUMULATIVE ROADWAY CHANGES

A number of roadway and intersection changes have been planned, as part of previous planning efforts, to accommodate the buildout of the Ravenswood/4 Corners TOD Specific Plan and other already-approved projects within the study area. These roadway network changes are summarized below:

- **Willow Road and Bayfront Expressway**
  - Northbound shared left/through lane converted to left turn only lane
  - Added a third northbound right turn only lane
- **University Avenue and Bay Road**
  - Added a northbound right turn only lane
  - Added a second westbound left turn only lane
- **University Avenue and Donohoe Street**
  - Added a southbound right turn only lane
  - Westbound approach converted to include dual left turn only lanes, one through lane, and one right turn only lane
- **Pulgas Avenue and Bay Road**
  - Converted from all-way stop control to a signalized intersection

- **New "Loop" Road**
  - New "Loop" Road constructed, with the new road extending northward from the current termination point of Demeter Street, turning west at a point just south of the Dumbarton Rail Line, and connecting with University Avenue near the East Palo Alto city limits

East Palo Alto City staff was consulted throughout the process of assembling and finalizing this list of planned roadway network and intersection modifications. These changes to the roadway network are assumed to occur under both the Cumulative No Project and Cumulative with Project scenarios. Figure 15 illustrates the intersection lane configurations that will result once these intersection modifications are complete.

4.3 CUMULATIVE INTERSECTION LEVELS OF SERVICE

Synchro Version 9 traffic analysis software was used to calculate automobile level of service for the study intersections under Cumulative conditions. The results for the Cumulative No Project and Cumulative with Project scenarios are summarized in Table 10. The table presents the level of service (LOS) standard for each intersection, the calculated LOS of each intersection for both the AM and PM peak periods, and the average intersection delay. Appendix A contains the corresponding LOS calculation sheets.

Table 10 Cumulative Without and with Project Peak Hour Intersection Levels of Service

Intersection	LOS Standard	Peak Hour	Cumulative No Project		Cumulative with Project	
			LOS	Delay (sec)	LOS	Delay (sec)
1. University Ave & Bayfront Expressway	D	AM	C	30	C	30
		PM	**F**	**235**	**F**	**233**
2. Willow Rd & Bayfront Expressway	D	AM	**E**	**62**	**E**	**65**
		PM	**F**	**159**	**F**	**145**
3. Willow Rd & Newbridge St	D	AM	C	34	C	35
		PM	C	33	C	33
4. University Ave & Bay Rd	D	AM	D	45	D	46
		PM	D	53	**E**	**63**
5. University Ave & Donohoe St	D	AM	D	46	**E**	**60**
		PM	**F**	**123**	**F**	**121**
6. University Ave & Woodland Ave	D	AM	**E**	**56**	**E**	**55**
		PM	D	39	D	41
7. Bay Rd & Pulgas Ave	D	AM	B	15	B	15
		PM	C	21	C	20
8. E. Bayshore Rd & Clarke Ave	D	AM	B	14	B	18
		PM	B	18	C	21
9. E. Bayshore Rd & Pulgas Ave	D	AM	C	33	D	37
		PM	**E**	**61**	**E**	**63**
10. Bay Rd & Newbridge St (all way stop)	D	AM	**E**	**38**	**E**	**39**
		PM	**E**	**37**	**E**	**38**

Figure 11: Cumulative No Project A.M. Peak Hour Traffic Volumes

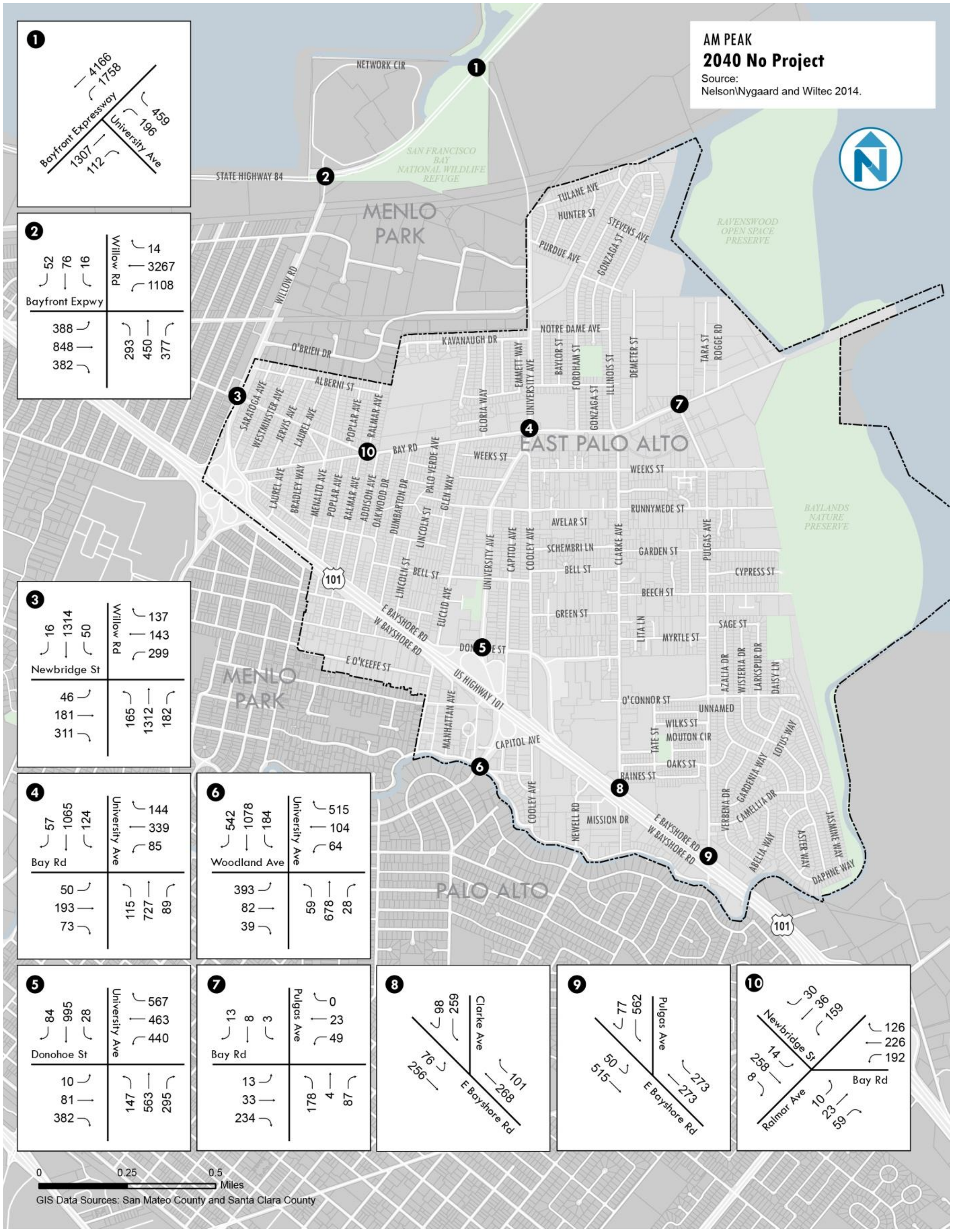


Figure 12: Cumulative No Project P.M. Peak Hour Traffic Volumes

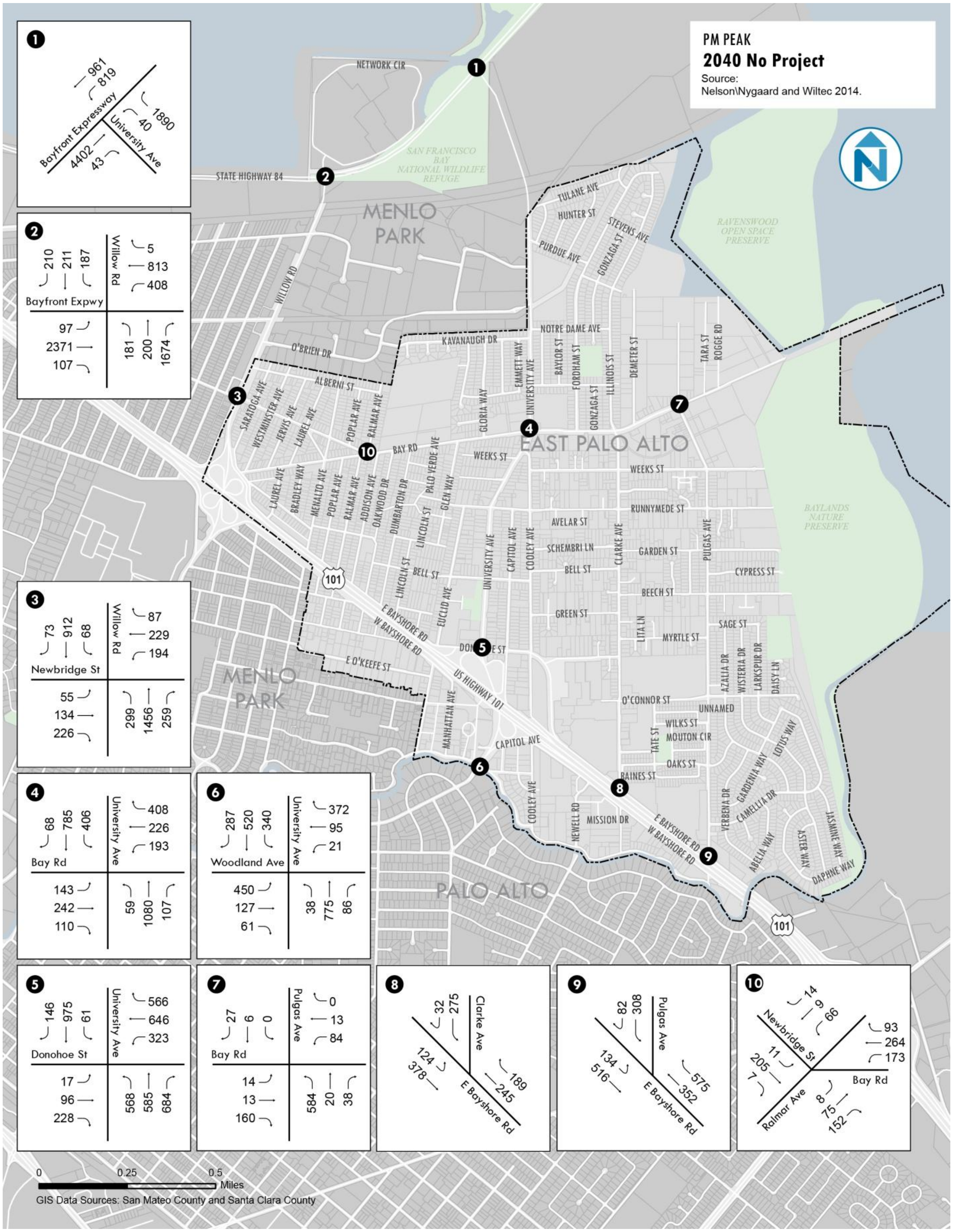


Figure 13: Cumulative With Project A.M. Peak Hour Traffic Volumes

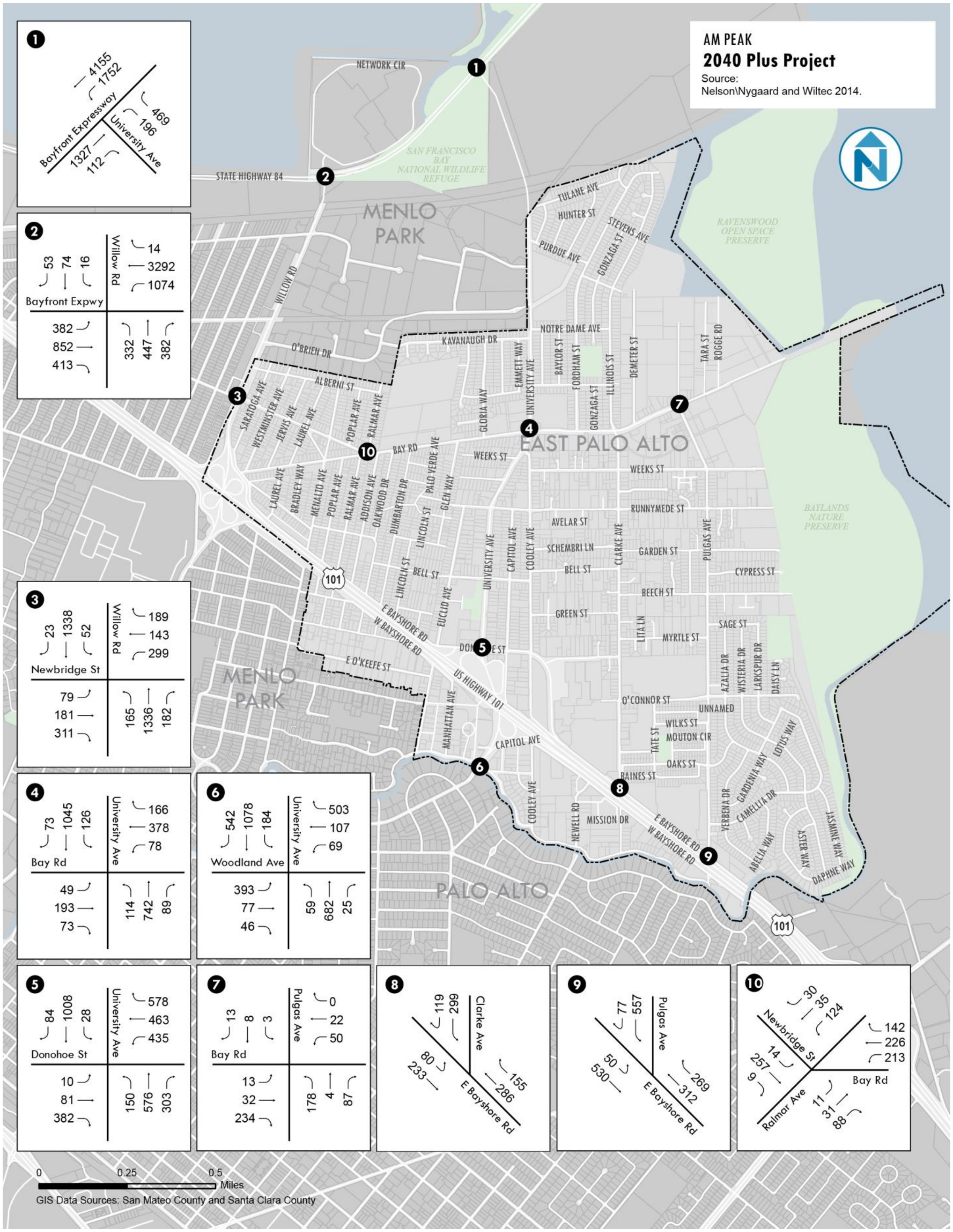


Figure 14: Cumulative With Project P.M. Peak Hour Traffic Volumes

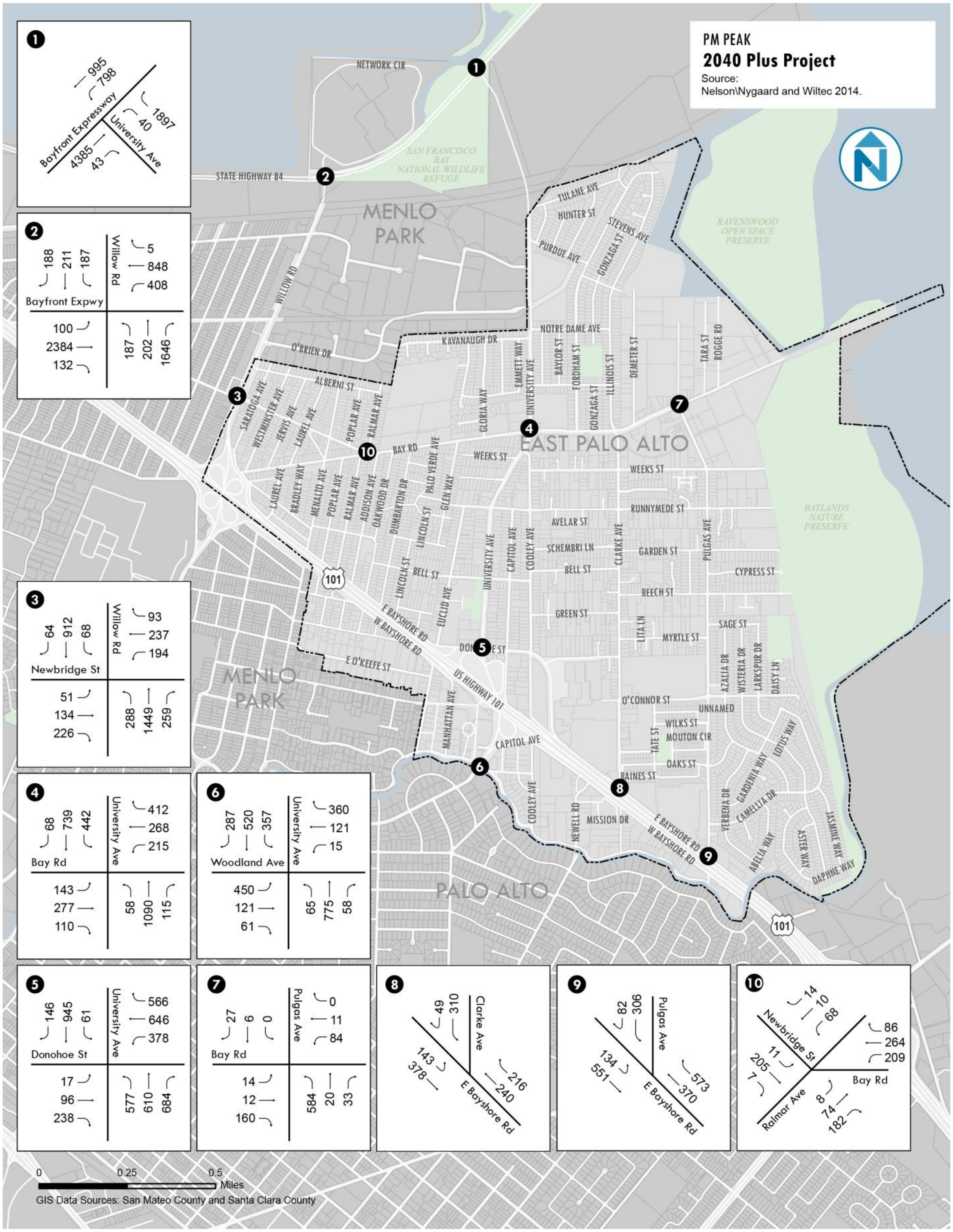
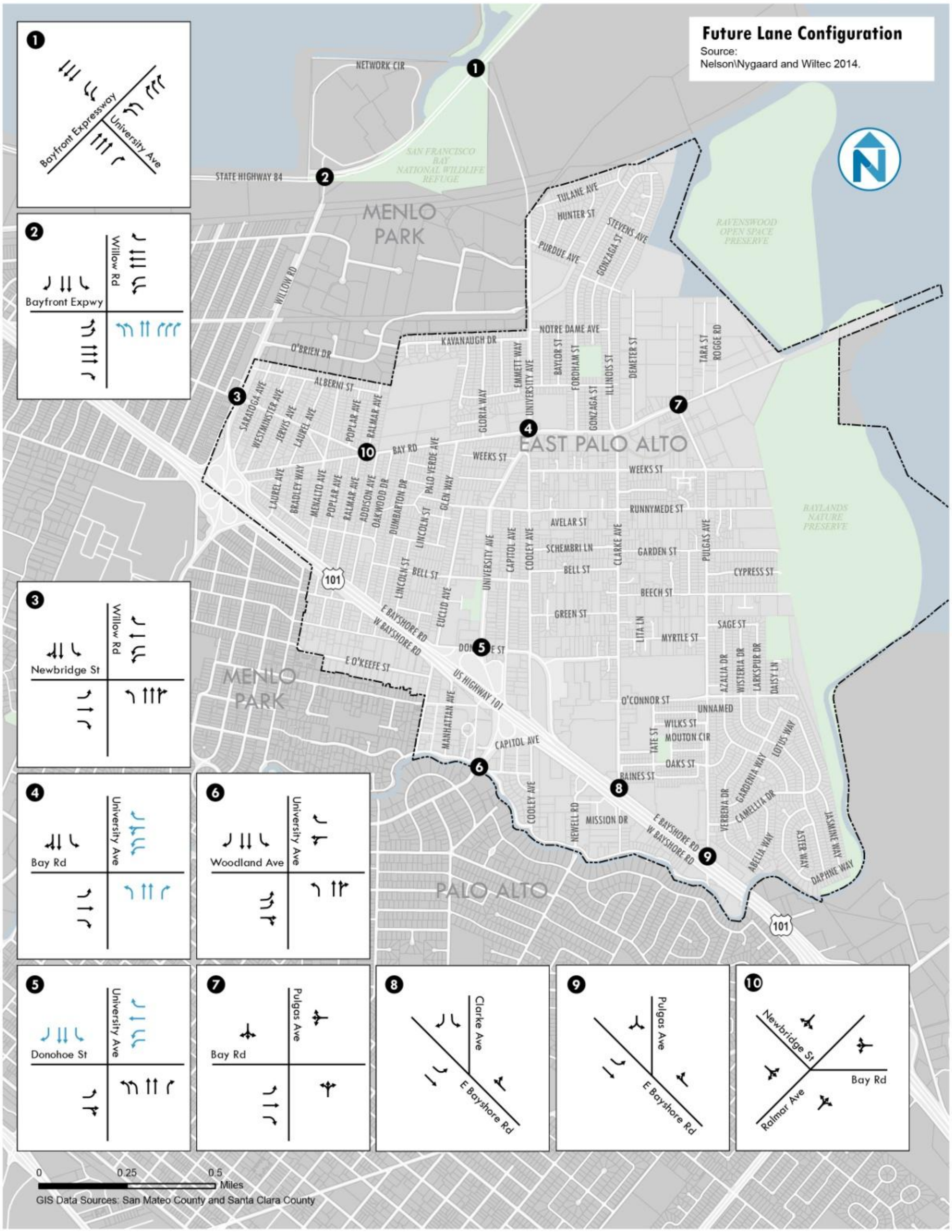


Figure 15: Assumed Future Intersection Lane Configurations



As shown in Table 10, under Cumulative No Project conditions, the following study intersections are projected to operate at levels of service that do not meet their designated LOS standards during at least one peak hour:

- University Avenue and Bayfront Expressway, in Menlo Park (PM)
- Willow Road and Bayfront Expressway, in Menlo Park (AM and PM)
- University Avenue and Donohoe Street, in East Palo Alto (PM)
- University Avenue and Woodland Avenue, in East Palo Alto (AM)
- East Bayshore Road and Pulgas Avenue, in East Palo Alto (PM)
- Bay Road and Newbridge Street, in East Palo Alto (AM and PM)

4.4 CUMULATIVE IMPACTS & MITIGATION MEASURES

This section evaluates the intersection LOS results presented in Table 10 against the criteria for significant transportation impacts described in Chapter 1, Section 1.6, Significance Criteria. Cumulative with Project conditions were evaluated relative to Cumulative No Project conditions to determine potential project impacts. This section also presents mitigation measures for identified project impacts. Mitigation measures are also included as policies and/or implementation actions in the General Plan.

East Palo Alto intends to adopt a multimodal transportation impact fee, as required by General Plan Circulation Element Policy 1.39.[8] Proceeds from the fee will be used to fund the pedestrian, bicycle, transit and TDM facilities and services outlined in the General Plan, in order to support future development within the City of East Palo Alto. The impact fee will be used to fund improvements as they become warranted based on the development pattern that occurs in the City.

Automobile Delay Impacts

Under Cumulative with Project conditions, relative to Cumulative No Project conditions, significant automobile delay impacts are projected to occur at the following study intersections:

- University Avenue and Bay Road (PM)
- University Avenue and Donohoe Street (AM)

Impact TRA-1 (University Avenue and Bay Road): This intersection is projected to operate at acceptable levels of service during the AM and PM peak hours under Cumulative No Project conditions. The addition of project-generated traffic is expected to cause the PM peak hour level of service to change from LOS D to LOS E. This constitutes a **significant impact** according to the thresholds established by the City of East Palo Alto.

Mitigation Measure TRA-1: Fully mitigating the project impacts at this intersection under cumulative conditions would require adding through lanes on University Avenue and/or Bay Road. Because such improvements would entail extensive right-of-way acquisition and roadway widening, this mitigation measure is considered to be infeasible. Building and operating the pedestrian, bicycle, and transit facilities and services outlined in the General Plan Update and in the Ravenswood/4 Corners Specific Plan, and implementing the TDM policies in those plans, may cause a reduction in the vehicle trips generated by buildout of the Project. Implementation of some transit facilities and services, such as building and operating a new high-capacity transit service on the Dumbarton Rail Corridor, would require additional funding from

[8] Note that the recently approved Ravenswood/4 Corners TOD Specific Plan's Policy TRA-2.5 also requires that the City adopt a traffic impact fee to fund the mitigation measures required to support future development within the Specific Plan area.

outside agencies, and coordination with and approval by other jurisdictions, such as the San Mateo County Transportation Authority and the San Mateo County Transit District.

Significance after Mitigation: Because implementation of some transit facilities and services would require additional funding from outside agencies and the approval of outside agencies and the City cannot guarantee they would be implemented, and because the effects of the pedestrian, bicycle, transit and TDM measures on vehicle trips are uncertain, the impact is considered to be **significant and unavoidable**.

Impact TRA-2 (University Avenue and Donohoe Street): Under Cumulative No Project Conditions, this intersection is projected to operate at acceptable levels of service during AM peak hour, and at LOS F during the AM peak hour. The addition of project-generated traffic is expected to cause the AM peak hour level of service to change from LOS D to LOS E. This constitutes a **significant impact** according to the thresholds established by the City of East Palo Alto.

Mitigation Measure TRA-2: Fully mitigating the project impacts at this intersection under cumulative conditions would require adding additional lanes on University Avenue and/or Donohoe Street. Because such improvements would entail extensive right-of-way acquisition and roadway widening, this mitigation measure is considered to be infeasible. Building and operating the pedestrian, bicycle, and transit facilities and services outlined in the General Plan Update and in the Ravenswood/4 Corners Specific Plan, and implementing the TDM policies in those plans, may cause a reduction in the vehicle trips generated by buildout of the Project. Implementation of some transit facilities and services, such as building and operating a new high-capacity transit service on the Dumbarton Rail Corridor, would require additional funding from outside agencies, and coordination with and approval by other jurisdictions, such as the San Mateo County Transportation Authority and the San Mateo County Transit District.

Significance after Mitigation: Because implementation of some transit facilities and services would require additional funding from outside agencies and the approval of outside agencies and the City cannot guarantee they would be implemented, and because the effects of the pedestrian, bicycle, transit and TDM measures on vehicle trips are uncertain, the impact is considered to be **significant and unavoidable**.

Pedestrian Impacts

The proposed Project will increase the City's population and can therefore be expected to increase the number of pedestrians in various parts of the City. With new developments, construction or upgrading of pedestrian facilities will be required and will enhance the overall pedestrian network. However, increased vehicle trips due to new development may make crossing streets (e.g., at uncontrolled intersections) more difficult. Pedestrian crossing times and/or exposure at signalized intersections are not expected to change substantially due to the project since no new roadway or intersection widenings are proposed.

Implementing the policies regarding pedestrians set forth in the proposed General Plan will complete the City's pedestrian network and substantially improve conditions for walking. These include Policy 1.1 Vision Zero; Policy 1.2, Traffic Calming, Policy 1.3; Safe Routes to Schools; Policy 1.4, ADA-Compliant Sidewalks; Policy 1.11, Pedestrian and Bicycle Crossings; Policy 1.15, Pedestrian Network; Policy 1.16, Pedestrian and Bicycling Education, Encouragement and Awareness; and Policy 1.29, Access to Transit. As described above, East Palo Alto intends to adopt a multimodal transportation impact fee, as required by General Plan Circulation Element Policy 1.39, to fund these pedestrian improvements.

Based on the above considerations, the project has a **less-than-significant impact** to the pedestrian network.

Bicycle Impacts

The proposed Project will increase the City's population and can therefore be expected to increase the number of bicyclists in various parts of the City. With new developments, construction or upgrading of bicycle facilities will be required and will enhance the overall bicycle network. However, increased vehicle trips due to new development may make riding along and crossing streets more difficult. Bicycle crossing times and/or exposure at signalized intersections are not expected to change substantially due to the project since no new roadway or intersection widenings are proposed.

Implementing the policies regarding pedestrians set forth in the proposed General Plan will complete the City's bicycle network and substantially improve conditions for cyclists. These include Policy 1.1 Vision Zero; Policy 1.2, Traffic Calming, Policy 1.3; Safe Routes to Schools; Policy 1.11, Pedestrian and Bicycle Crossings; Policy 1.16, Pedestrian and Bicycling Education, Encouragement and Awareness; Policy 1.18, Bicycle Network; Policy 1.19, Bicycle Transportation Plan; Policy 1.21 Bicycle Safety; Policy 1.25, San Francisco Bay Trail and Policy 1.29, Access to Transit. As described above, East Palo Alto intends to adopt a multimodal transportation impact fee, as required by General Plan Circulation Element Policy 1.39, to fund these bicycle improvements.

Based on the above considerations, the project has a **less-than-significant impact** to the bicycle network.

Transit Impacts

The proposed Project will increase the City's population of residents and employees and can therefore be expected to increase overall transit demand. This increase would include both demand for bus transit in the City and demand for rail transit (Caltrain) at the Palo Alto Station. Both SamTrans and Caltrain are improving service and plan to provide sufficient facilities and services to accommodate this modest increase in ridership.

However, traffic delays on streets with bus service may affect service efficiency. **SamTrans** may experience impacts during the peak hour on the following routes:

- **Route 281, 297, and 397** may experience increased delays on University Avenue
- **Route 296** may experience increased delays on University Avenue and Donohoe Street

Implementing the policies regarding transit set forth in the proposed General Plan, such as advanced traffic control measures to provide transit vehicles with priority at traffic signals on transit network streets, should allow buses to maintain schedules and provide necessary service. These policies include Policy 1.27, Coordination with Transit Agencies; Policy 1.28, Transit Priority; Policy 1.29, Access to Transit; Policy 1.3, Transit Stops, and Policy 1.31, Local Transportation Services.

Based on the above considerations, the project has a **less-than-significant impact** to the transit network.

4.5 ROADWAY SEGMENT LEVEL OF SERVICE ANALYSIS

To supplement the intersection level of service analysis presented in the previous section, automobile level of service was also evaluated by calculating volume-to-capacity (V/C) ratios for 10 roadway study segments. The V/C ratios were calculated based on existing or future average daily traffic (ADT) volumes and daily capacity values for various types of roadways. The results of this analysis for the Existing Conditions, Cumulative No Project, and Cumulative with Project scenarios are summarized in Table 11. For each roadway study segment, the table presents the roadway classification; the daily capacity value for the roadway (used to calculate V/C ratios), as set forth in East Palo Alto's 1999 General Plan; and the average daily traffic, volume-to-capacity ratio, and calculated level of service under each scenario.

While this average daily traffic-based methodology is a considerably rougher, "sketch level" method of estimating automobile level of service, it was included in this analysis because East Palo Alto's 1999 General Plan EIR evaluated level of service using this methodology.[9] The 1999 General Plan notes that "due to the generalized nature of ADT capacities, the values are typically viewed as general rather than absolute guides for estimating level of service and sizing the future roadway system."[10] The City of East Palo Alto's performance criteria for evaluating automobile level of service on the City's roadways using this ADT-based approach is LOS D. When using this average daily traffic-based approach to automobile level of service analysis, a significant transportation impact results if the Project:

- causes a roadway operating at LOS D or better to operate at LOS E or F
- causes a substantial increase in traffic on a roadway already projected to operate at LOS E or F

4.6 CUMULATIVE ROADWAY SEGMENT ANALYSIS IMPACTS & MITIGATION MEASURES

This section evaluates the roadway study segment LOS results presented in Table 11 against the criteria for significant transportation impacts described in Chapter 1, Section 1.6, Significance Criteria, and in the section above. Cumulative with Project conditions were evaluated relative to Cumulative No Project conditions to determine potential project impacts. This section also presents mitigation measures for identified project impacts. Mitigation measures are also included as policies and/or implementation actions in the General Plan.

East Palo Alto intends to adopt a multimodal transportation impact fee, as required by **General Plan Circulation Element Policy 1.39**.[11] Proceeds from the fee will be used to fund the pedestrian, bicycle, transit and TDM facilities and services outlined in the General Plan, in order to support future development within the City of East Palo Alto. The impact fee will be used to fund improvements as they become warranted based on the development pattern that occurs in the City.

Under Cumulative with Project conditions, relative to Cumulative No Project conditions, significant automobile delay impacts are projected to occur on the following roadway study segments:

- University Avenue between Michigan Avenue and Bay Road
- Donohoe Street between University Avenue and Capitol Avenue

Impact TRA-3 (University Avenue between Michigan Avenue and Bay Road): This roadway segment is projected to operate at LOS E under Cumulative No Project conditions. The addition of project-generated traffic is expected to cause the level of service to change from LOS E to LOS F. This constitutes a **significant impact** according to the thresholds established by the City of East Palo Alto.

Mitigation Measure TRA-3: Fully mitigating the project impacts on this roadway segment under cumulative conditions would require adding through lanes on University Avenue. Because such improvements would entail extensive right-of-way acquisition and roadway widening, this mitigation measure is considered to be infeasible. Building and operating the pedestrian, bicycle, and transit facilities and services outlined in the General Plan Update and in the Ravenswood/4 Corners Specific Plan, and implementing the TDM policies in those plans, may cause a reduction in the vehicle trips generated by buildout of the Project. Implementation of some transit facilities and services, such as building and operating

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[9] 1999 East Palo Alto General Plan Circulation Element, p. 11-14.

[10] Ibid, p. 14.

[11] Note that the recently approved Ravenswood/4 Corners TOD Specific Plan's Policy TRA-2.5 also requires that the City adopt a traffic impact fee to fund the mitigation measures required to support future development within the Specific Plan area.

a new high-capacity transit service on the Dumbarton Rail Corridor, would require additional funding from outside agencies, and coordination with and approval by other jurisdictions, such as the San Mateo County Transportation Authority and the San Mateo County Transit District.

Significance after Mitigation: Because implementation of some transit facilities and services would require additional funding from outside agencies and the approval of outside agencies and the City cannot guarantee they would be implemented, and because the effects of the pedestrian, bicycle, transit and TDM measures on vehicle trips are uncertain, the impact is considered to be **significant and unavoidable**.

Impact TRA-4 (Donohoe Street between University Avenue and Capitol Avenue): Under Cumulative No Project Conditions, this roadway segment is projected to operate at LOS E. The addition of project-generated traffic is expected to cause the V/C ratio to change from 0.99 to 1.00, with the roadway segment continuing to operate at LOS E. This increase in the V/C ratio could be considered a "substantial increase in traffic on a roadway already projected to operate at LOS E or F". This could be considered to constitute a **significant impact** according to the thresholds established by the City of East Palo Alto.

Mitigation Measure TRA-4: Fully mitigating the project impacts on this roadway segment under cumulative conditions would require adding through lanes on Donohoe Street and/or University Avenue. Because such improvements would entail extensive right-of-way acquisition and roadway widening, this mitigation measure is considered to be infeasible. Building and operating the pedestrian, bicycle, and transit facilities and services outlined in the General Plan Update and in the Ravenswood/4 Corners Specific Plan, and implementing the TDM policies in those plans, may cause a reduction in the vehicle trips generated by buildout of the Project. Implementation of some transit facilities and services, such as building and operating a new high-capacity transit service on the Dumbarton Rail Corridor, would require additional funding from outside agencies, and coordination with and approval by other jurisdictions, such as the San Mateo County Transportation Authority and the San Mateo County Transit District.

Significance after Mitigation: Because implementation of some transit facilities and services would require additional funding from outside agencies and the approval of outside agencies and the City cannot guarantee they would be implemented, and because the effects of the pedestrian, bicycle, transit and TDM measures on vehicle trips are uncertain, the impact is considered to be **significant and unavoidable**.

Table 11 Roadway Segment Analysis

			Existing Conditions			Cumulative No Project Conditions			Cumulative with Project Conditions		
Location	Roadway Classification	ADT Capacity	2015 ADT	V/C Ratio	Segment LOS	2040 No Project ADT	V/C Ratio	Segment LOS	2040 Plus Project ADT	V/C Ratio	Segment LOS
Bay Road between Gloria Way and University Avenue	Collector	12,500	8,410	0.67	B	10,055	0.80	C	10,224	0.82	D
University Avenue between Michigan Avenue and Bay Road	Arterial	37,500	25,610	0.68	B	**36,316**	**0.97**	**E**	**37,832**	**1.01**	**F**
Runnymede Street between Cooley Avenue and Clarke Avenue	Neighborhood (Local)	12,500	3,410	0.27	A	4,273	0.34	A	4,536	0.36	A
Euclid Avenue between Bell Street Park Place and Donohoe Street	Neighborhood (Local)	12,500	3,498	0.28	A	4,976	0.40	A	5,124	0.41	A
Clarke Avenue between Donohoe Street and O'Connor Street	Collector	12,500	7,231	0.58	A	10,743	0.86	D	10,443	0.84	D
Pulgas Avenue between Myrtle Street and O'Connor Street	Collector	12,500	7,137	0.57	A	7,764	0.62	B	7,884	0.63	B
Donohoe Street between University Avenue and Capitol Avenue	Arterial	37,500	**34,120**	**0.91**	**E**	**36,957**	**0.99**	**E**	**37,448**	**1.00**	**E**
East Bayshore Road between Glen Way and Euclid Avenue	Collector	12,500	10,218	0.82	D	10,218	0.82	D	10,218	0.82	D
East Bayshore Road between Clarke Avenue and Pulgas Avenue	Collector	12,500	9,444	0.76	C	**14,107**	**1.13**	**F**	**13,975**	**1.12**	**F**
West Bayshore Road between Cooley Avenue and Newell Road	Collector	12,500	4,780	0.38	A	5,598	0.45	A	5,516	0.44	A

APPENDIX A

Level of Service Worksheets

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	196	378	914	112	1494	3453
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	202	390	942	115	1540	3560
RTOR Reduction (vph)	0	3	0	19	0	0
Lane Group Flow (vph)	202	387	942	96	1540	3560
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	11.0	86.5	29.0	104.1	71.5	104.1
Effective Green, g (s)	11.5	87.0	29.5	104.6	72.0	104.6
Actuated g/C Ratio	0.09	0.70	0.24	0.84	0.58	0.84
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	315	2512	1200	1324	1977	4255
v/s Ratio Prot	c0.06	0.11	0.19		0.45	c0.70
v/s Ratio Perm				0.06		
v/c Ratio	0.64	0.15	0.79	0.07	0.78	0.84
Uniform Delay, d1	54.8	6.5	44.8	1.8	20.4	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.6	0.1	5.2	0.1	3.1	2.1
Delay (s)	64.4	6.6	50.0	1.9	23.5	7.7
Level of Service	E	A	D	A	C	A
Approach Delay (s)	26.3		44.7			12.4
Approach LOS	C		D			B

Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.1%	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)	198	646	118	1063	2604	14	95	290	363	16	56	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1610	3385	2787	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	1610	3385	2787	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	200	653	119	1074	2630	14	96	293	367	16	57	32
RTOR Reduction (vph)	0	0	96	0	0	6	0	0	152	0	0	30
Lane Group Flow (vph)	200	653	23	1074	2630	8	86	303	215	16	57	2
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pt+ov	Split	NA	Prot
Protected Phases	1	6		5	2		7	7	7 5	8	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	10.8	19.5	19.5	49.5	59.3	59.3	10.7	10.7	60.2	5.2	5.2	5.2
Effective Green, g (s)	11.3	20.0	20.0	50.0	59.8	59.8	11.2	11.2	61.2	5.7	5.7	5.7
Actuated g/C Ratio	0.11	0.19	0.19	0.48	0.57	0.57	0.11	0.11	0.59	0.05	0.05	0.05
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4		4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2		2.0	2.0	2.0
Lane Grp Cap (vph)	371	974	303	1644	2912	906	172	363	1633	96	193	86
v/s Ratio Prot	0.06	0.13		c0.31	c0.52		0.05	c0.09	0.08	0.01	c0.02	0.00
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.54	0.67	0.08	0.65	0.90	0.01	0.50	0.83	0.13	0.17	0.30	0.02
Uniform Delay, d1	44.1	39.1	34.6	20.6	19.7	9.6	44.0	45.7	9.7	47.1	47.4	46.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	1.8	0.1	0.7	4.4	0.0	1.2	14.7	0.0	0.3	0.3	0.0
Delay (s)	44.8	41.0	34.7	21.3	24.1	9.6	45.1	60.4	9.7	47.4	47.7	46.7
Level of Service	D	D	C	C	C	A	D	E	A	D	D	D
Approach Delay (s)		41.0			23.3			34.0			47.4	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	104.4	Sum of lost time (s)	17.5
Intersection Capacity Utilization	80.5%	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												
Volume (vph)	46	181	311	299	143	49	165	1267	182	37	1314	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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4989		1770	3535	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4989		1770	3535	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	49	195	334	322	154	53	177	1362	196	40	1413	11
RTOR Reduction (vph)	0	0	273	0	0	46	0	13	0	0	1	0
Lane Group Flow (vph)	49	195	61	322	154	7	177	1545	0	40	1423	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	15.1	15.1	15.1	13.9	13.9	13.9	14.1	53.2		4.8	43.9	
Effective Green, g (s)	15.1	15.1	15.1	12.9	12.9	12.9	13.1	54.2		3.8	44.9	
Actuated g/C Ratio	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.53		0.04	0.44	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	262	275	234	434	235	200	227	2651		65	1556	
v/s Ratio Prot	0.03	c0.10	0.04	c0.09	0.08	0.00	c0.10	0.31		0.02	c0.40	
v/s Ratio Perm												
v/c Ratio	0.19	0.71	0.26	0.74	0.66	0.03	0.78	0.58		0.62	0.91	
Uniform Delay, d1	38.1	41.4	38.5	42.9	42.4	39.1	43.1	16.2		48.4	26.8	
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	6.7	0.2	5.9	4.9	0.0	14.2	0.9		11.5	9.9	
Delay (s)	38.2	48.0	38.7	48.8	47.4	39.1	57.3	17.2		59.9	36.6	
Level of Service	D	D	D	D	D	D	E	B		E	D	
Approach Delay (s)		41.8			47.4			21.3			37.3	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.2%	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)	48	193	73	78	239	108	78	522	89	124	973	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1681	1766	1583	1770	3462		1770	3518	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1681	1766	1583	1770	3462		1770	3518	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	49	199	75	80	246	111	80	538	92	128	1003	42
RTOR Reduction (vph)	0	0	65	0	0	91	0	11	0	0	2	0
Lane Group Flow (vph)	49	199	11	71	255	20	80	619	0	128	1043	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	18.2	18.2	18.2	23.0	23.0	23.0	9.1	56.5		16.8	64.7	
Effective Green, g (s)	18.2	18.2	18.2	23.0	23.0	23.0	8.6	56.5		16.3	64.2	
Actuated g/C Ratio	0.14	0.14	0.14	0.18	0.18	0.18	0.07	0.43		0.13	0.49	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0		3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0		1.5	2.5	
Lane Grp Cap (vph)	247	260	221	297	312	280	117	1504		221	1737	
v/s Ratio Prot	0.03	c0.11	0.01	0.04	c0.14	0.01	c0.05	0.18		c0.07	c0.30	
v/s Ratio Perm												
v/c Ratio	0.20	0.77	0.05	0.24	0.82	0.07	0.68	0.41		0.58	0.60	
Uniform Delay, d1	49.4	53.8	48.4	46.0	51.5	44.6	59.4	25.3		53.6	23.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.18	0.80		1.00	1.00	
Incremental Delay, d2	0.1	11.4	0.0	0.2	14.4	0.0	11.1	0.7		2.3	1.5	
Delay (s)	49.6	65.3	48.4	46.1	65.9	44.6	81.0	20.9		55.9	25.2	
Level of Service	D	E	D	D	E	D	F	C		E	C	
Approach Delay (s)		59.0			57.3			27.7			28.6	
Approach LOS		E			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
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 (vph)	9	81	382	435	463	439	145	362	295	28	915	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frt	1.00	0.88		1.00	0.97	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1632		1610	3091	1441	3433	3539	1583	1770	3495	
Flt Permitted	0.95	1.00		0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1632		1610	3091	1441	3433	3539	1583	1770	3495	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	10	90	424	483	514	488	161	402	328	31	1017	93
RTOR Reduction (vph)	0	116	0	0	14	238	0	0	0	0	5	0
Lane Group Flow (vph)	10	398	0	377	752	104	161	402	328	31	1105	0
Turn Type	Split	NA		Split	NA	Prot	Prot	NA	Over	Prot	NA	
Protected Phases	8	8		7	7	7	5	2	7	1	6	
Permitted Phases												
Actuated Green, G (s)	32.8	32.8		38.6	38.6	38.6	6.1	37.5	38.6	3.6	36.0	
Effective Green, g (s)	32.3	32.3		39.6	39.6	39.6	6.1	38.5	39.6	3.6	36.0	
Actuated g/C Ratio	0.25	0.25		0.30	0.30	0.30	0.05	0.30	0.30	0.03	0.28	
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	
Lane Grp Cap (vph)	439	405		490	941	438	161	1048	482	49	967	
v/s Ratio Prot	0.01	c0.24		0.23	c0.24	0.07	c0.05	0.11	0.21	0.02	c0.32	
v/s Ratio Perm												
v/c Ratio	0.02	0.98		0.77	0.80	0.24	1.00	0.38	0.68	0.63	1.14	
Uniform Delay, d1	36.9	48.6		41.1	41.5	33.9	62.0	36.3	39.7	62.5	47.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00	0.91	1.09	0.95	0.86	1.25	
Incremental Delay, d2	0.0	39.5		7.6	5.1	0.4	67.9	0.3	3.9	15.5	75.0	
Delay (s)	36.9	88.1		48.6	46.6	34.3	124.0	39.7	41.5	69.3	133.9	
Level of Service	D	F		D	D	C	F	D	D	E	F	
Approach Delay (s)		87.1			44.3			55.6			132.1	
Approach LOS		F			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	77.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.2%	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)	393	56	39	20	88	297	59	649	10	184	1078	542
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
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.94			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1749			1845	1583	1770	3531		1770	3539	1583
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1749			1845	1583	1770	3531		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	405	58	40	21	91	306	61	669	10	190	1111	559
RTOR Reduction (vph)	0	23	0	0	0	238	0	1	0	0	0	240
Lane Group Flow (vph)	405	75	0	0	112	68	61	678	0	190	1111	319
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	20.2	20.2			13.1	13.1	9.5	61.3		18.8	70.6	70.6
Effective Green, g (s)	20.8	20.8			12.1	12.1	10.0	61.8		19.3	71.1	71.1
Actuated g/C Ratio	0.16	0.16			0.09	0.09	0.08	0.48		0.15	0.55	0.55
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	549	279			171	147	136	1678		262	1935	865
v/s Ratio Prot	c0.12	0.04			c0.06	0.04	0.03	0.19		c0.11	c0.31	
v/s Ratio Perm												0.20
v/c Ratio	0.74	0.27			0.65	0.47	0.45	0.40		0.73	0.57	0.37
Uniform Delay, d1	52.0	47.9			56.9	55.9	57.4	22.1		52.8	19.5	16.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		0.84	1.14	3.86
Incremental Delay, d2	4.4	0.2			6.7	0.8	0.9	0.7		0.8	0.1	0.1
Delay (s)	56.4	48.1			63.6	56.7	58.2	22.9		45.1	22.4	64.6
Level of Service	E	D			E	E	E	C		D	C	E
Approach Delay (s)		54.8			58.6			25.8			37.4	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.0%	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)	13	25	234	5	10	0	178	4	5	2	8	13
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	15	28	263	6	11	0	200	4	6	2	9	15
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	11			291			99	80	28	88	343	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			291			99	80	28	88	343	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			77	99	99	100	98	99
cM capacity (veh/h)	1608			1271			852	800	1047	880	572	1070

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	15	28	263	17	210	26
Volume Left	15	0	0	6	200	2
Volume Right	0	0	263	0	6	15
cSH	1608	1700	1700	1271	855	809
Volume to Capacity	0.01	0.02	0.15	0.00	0.25	0.03
Queue Length 95th (ft)	1	0	0	0	24	2
Control Delay (s)	7.3	0.0	0.0	2.6	10.6	9.6
Lane LOS	A			A	B	A
Approach Delay (s)	0.3			2.6	10.6	9.6
Approach LOS					B	A

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	214	98	76	233	175	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1805	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	230	105	82	251	188	56
RTOR Reduction (vph)	0	74	0	0	7	0
Lane Group Flow (vph)	230	31	82	251	237	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	13.2	13.2	4.8	21.8	14.0	
Effective Green, g (s)	13.2	13.2	4.8	21.8	14.0	
Actuated g/C Ratio	0.30	0.30	0.11	0.49	0.31	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	525	469	190	912	567	
v/s Ratio Prot	c0.13	0.02	c0.05	0.13	c0.13	
v/s Ratio Perm						
v/c Ratio	0.44	0.07	0.43	0.28	0.42	
Uniform Delay, d1	12.7	11.2	18.6	6.7	12.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.1	0.6	0.2	0.6	
Delay (s)	13.3	11.3	19.1	6.9	12.6	
Level of Service	B	B	B	A	B	
Approach Delay (s)	12.7			9.9	12.6	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	12.5
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	501	75	50	445	100	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.92	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1754		1770	1863	1720	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1754		1770	1863	1720	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	569	85	57	506	114	149
RTOR Reduction (vph)	6	0	0	0	70	0
Lane Group Flow (vph)	648	0	57	506	193	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	21.2		3.2	20.6	13.4	
Effective Green, g (s)	22.2		2.2	21.1	13.9	
Actuated g/C Ratio	0.45		0.04	0.42	0.28	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	781		78	789	480	
v/s Ratio Prot	c0.37		0.03	c0.27	0.11	
v/s Ratio Perm						
v/c Ratio	0.83		0.73	0.64	0.40	
Uniform Delay, d1	12.1		23.5	11.4	14.6	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	7.7		25.8	1.9	0.7	
Delay (s)	19.8		49.3	13.2	15.2	
Level of Service	B		D	B	B	
Approach Delay (s)	19.8			16.9	15.2	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	49.8	Sum of lost time (s)	11.5
Intersection Capacity Utilization	62.4%	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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	257	8	31	226	112	10	23	56	124	35	30
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	17	310	10	37	272	135	12	28	67	149	42	36

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	336	445	107	228
Volume Left (vph)	17	37	12	149
Volume Right (vph)	10	135	67	36
Hadj (s)	0.03	-0.13	-0.32	0.07
Departure Headway (s)	5.8	5.5	6.4	6.4
Degree Utilization, x	0.54	0.68	0.19	0.41
Capacity (veh/h)	582	631	450	502
Control Delay (s)	15.5	19.3	10.9	13.7
Approach Delay (s)	15.5	19.3	10.9	13.7
Approach LOS	C	C	B	B

Intersection Summary			
Delay	16.2		
Level of Service	C		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	40	1643	3755	43	348	839
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	41	1694	3871	44	359	865
RTOR Reduction (vph)	0	1	0	4	0	0
Lane Group Flow (vph)	41	1693	3871	40	359	865
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	11.0	61.5	159.0	209.1	46.5	209.1
Effective Green, g (s)	11.5	62.0	159.5	209.6	47.0	209.6
Actuated g/C Ratio	0.05	0.27	0.69	0.91	0.20	0.91
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	171	973	3526	1442	701	4633
v/s Ratio Prot	0.01	c0.47	c0.76		0.10	0.17
v/s Ratio Perm				0.03		
v/c Ratio	0.24	1.74	1.10	0.03	0.51	0.19
Uniform Delay, d1	105.0	84.0	35.2	0.9	81.3	1.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.3	337.4	49.2	0.0	2.7	0.1
Delay (s)	108.3	421.4	84.4	1.0	84.0	1.2
Level of Service	F	F	F	A	F	A
Approach Delay (s)	414.0		83.5			25.5
Approach LOS	F		F			C

Intersection Summary			
HCM 2000 Control Delay	156.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	230.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	118.8%	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)	35	2004	54	408	689	5	29	75	1468	187	211	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.91	0.91	0.88	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1610	3384	2787	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	1610	3384	2787	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	35	2024	55	412	696	5	29	76	1483	189	213	187
RTOR Reduction (vph)	0	0	35	0	0	3	0	0	28	0	0	125
Lane Group Flow (vph)	35	2024	20	412	696	2	26	79	1455	189	213	62
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pt+ov	Split	NA	Prot
Protected Phases	1	6		5	2		7	7	7 5	8	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	56.6	59.0	59.0	61.8	65.3	65.3	10.6	10.6	72.4	13.5	13.5	13.5
Effective Green, g (s)	57.1	59.5	59.5	62.3	65.8	65.8	11.1	11.1	73.4	14.0	14.0	14.0
Actuated g/C Ratio	0.35	0.36	0.36	0.38	0.40	0.40	0.07	0.07	0.45	0.09	0.09	0.09
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4		4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2		2.0	2.0	2.0
Lane Grp Cap (vph)	1192	1840	572	1300	2035	633	108	228	1244	150	301	134
v/s Ratio Prot	0.01	c0.40		0.12	0.14		0.02	0.02	c0.52	c0.11	0.06	0.04
v/s Ratio Perm			0.01			0.00						
v/c Ratio	0.03	1.10	0.03	0.32	0.34	0.00	0.24	0.35	1.17	1.26	0.71	0.46
Uniform Delay, d1	35.4	52.5	33.9	36.0	34.3	29.6	72.7	73.2	45.5	75.2	73.2	71.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	54.0	0.0	0.1	0.1	0.0	0.6	0.5	85.4	159.6	6.1	0.9
Delay (s)	35.4	106.4	33.9	36.1	34.4	29.6	73.2	73.7	130.9	234.8	79.3	72.5
Level of Service	D	F	C	D	C	C	E	E	F	F	E	E
Approach Delay (s)		103.4			35.0			127.1			127.0	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	98.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	164.4	Sum of lost time (s)	17.5
Intersection Capacity Utilization	111.7%	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)	34	134	226	194	188	76	264	1371	259	68	912	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4964		1770	3528	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4964		1770	3528	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	37	144	243	209	202	82	284	1474	278	73	981	22
RTOR Reduction (vph)	0	0	214	0	0	71	0	19	0	0	1	0
Lane Group Flow (vph)	37	144	29	209	202	11	284	1733	0	73	1002	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	12.2	12.2	12.2	14.7	14.7	14.7	22.0	52.5		7.6	38.1	
Effective Green, g (s)	12.2	12.2	12.2	13.7	13.7	13.7	21.0	53.5		6.6	39.1	
Actuated g/C Ratio	0.12	0.12	0.12	0.13	0.13	0.13	0.21	0.52		0.06	0.38	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	211	222	189	461	250	212	364	2603		114	1352	
v/s Ratio Prot	0.02	c0.08	0.02	0.06	c0.11	0.01	c0.16	0.35		0.04	c0.28	
v/s Ratio Perm												
v/c Ratio	0.18	0.65	0.15	0.45	0.81	0.05	0.78	0.67		0.64	0.74	
Uniform Delay, d1	40.4	42.9	40.3	40.7	42.9	38.5	38.3	17.7		46.5	27.1	
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	4.8	0.1	0.3	16.3	0.0	9.6	1.4		8.8	3.7	
Delay (s)	40.5	47.7	40.4	41.0	59.2	38.5	47.9	19.1		55.4	30.8	
Level of Service	D	D	D	D	E	D	D	B		E	C	
Approach Delay (s)		42.9			48.0			23.1			32.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	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)	143	190	110	141	209	408	45	1061	37	127	427	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1681	1764	1583	1770	3521		1770	3487	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	1681	1764	1583	1770	3521		1770	3487	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	147	196	113	145	215	421	46	1094	38	131	440	48
RTOR Reduction (vph)	0	0	97	0	0	198	0	2	0	0	5	0
Lane Group Flow (vph)	147	196	16	129	231	223	46	1130	0	131	483	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	18.2	18.2	18.2	22.5	22.5	22.5	6.3	58.7		15.1	68.0	
Effective Green, g (s)	18.2	18.2	18.2	22.5	22.5	22.5	5.8	58.7		14.6	67.5	
Actuated g/C Ratio	0.14	0.14	0.14	0.17	0.17	0.17	0.04	0.45		0.11	0.52	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0		3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0		1.5	2.5	
Lane Grp Cap (vph)	247	260	221	290	305	273	78	1589		198	1810	
v/s Ratio Prot	0.08	c0.11	0.01	0.08	0.13	c0.14	0.03	c0.32		c0.07	0.14	
v/s Ratio Perm												
v/c Ratio	0.60	0.75	0.07	0.44	0.76	0.82	0.59	0.71		0.66	0.27	
Uniform Delay, d1	52.4	53.7	48.6	48.2	51.2	51.8	60.9	28.8		55.3	17.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.27	0.69		1.00	1.00	
Incremental Delay, d2	2.6	10.5	0.1	0.4	9.2	16.3	5.8	2.2		6.3	0.4	
Delay (s)	55.0	64.2	48.6	48.6	60.3	68.1	82.9	21.9		61.6	17.8	
Level of Service	E	E	D	D	E	E	F	C		E	B	
Approach Delay (s)		57.4			62.6			24.3			27.1	
Approach LOS		E			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	39.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.8%	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)	17	96	173	287	646	566	551	526	684	61	577	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.91	0.86	0.91	0.97	0.95	1.00	1.00	0.95	
Frt	1.00	0.90		1.00	0.97	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1683		1610	3100	1441	3433	3539	1583	1770	3432	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1683		1610	3100	1441	3433	3539	1583	1770	3432	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	19	107	192	319	718	629	612	584	760	68	641	162
RTOR Reduction (vph)	0	54	0	0	13	294	0	0	0	0	18	0
Lane Group Flow (vph)	19	245	0	249	964	146	612	584	760	68	785	0
Turn Type	Split	NA		Split	NA	Prot	Prot	NA	Over	Prot	NA	
Protected Phases	8	8		7	7	7	5	2	7	1	6	
Permitted Phases												
Actuated Green, G (s)	23.0	23.0		42.1	42.1	42.1	14.5	38.8	42.1	8.6	33.9	
Effective Green, g (s)	22.5	22.5		43.1	43.1	43.1	14.5	39.8	43.1	8.6	33.9	
Actuated g/C Ratio	0.17	0.17		0.33	0.33	0.33	0.11	0.31	0.33	0.07	0.26	
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	
Lane Grp Cap (vph)	306	291		533	1027	477	382	1083	524	117	894	
v/s Ratio Prot	0.01	c0.15		0.15	0.31	0.10	c0.18	0.17	c0.48	0.04	c0.23	
v/s Ratio Perm												
v/c Ratio	0.06	0.84		0.47	0.94	0.31	1.60	0.54	1.45	0.58	0.88	
Uniform Delay, d1	44.9	52.0		34.4	42.2	32.3	57.8	37.5	43.5	59.0	46.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.02	1.09	
Incremental Delay, d2	0.0	18.7		0.9	15.4	0.5	282.9	0.7	213.2	4.6	11.8	
Delay (s)	45.0	70.7		35.3	57.6	32.8	340.7	38.1	256.6	64.6	62.0	
Level of Service	D	E		D	E	C	F	D	F	E	E	
Approach Delay (s)		69.2			47.7			217.7			62.2	
Approach LOS		E			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	120.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.8%	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)	450	104	61	15	85	360	38	775	13	189	520	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	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.94			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1759			1849	1583	1770	3531		1770	3539	1583
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1759			1849	1583	1770	3531		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	464	107	63	15	88	371	39	799	13	195	536	296
RTOR Reduction (vph)	0	20	0	0	0	174	0	1	0	0	0	151
Lane Group Flow (vph)	464	150	0	0	103	197	39	811	0	195	536	145
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	21.3	21.3			18.8	18.8	5.0	45.9		17.4	58.3	58.3
Effective Green, g (s)	21.9	21.9			17.8	17.8	5.5	46.4		17.9	58.8	58.8
Actuated g/C Ratio	0.18	0.18			0.15	0.15	0.05	0.39		0.15	0.49	0.49
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	626	321			274	234	81	1365		264	1734	775
v/s Ratio Prot	c0.14	0.09			0.06	c0.12	0.02	c0.23		c0.11	0.15	
v/s Ratio Perm												0.09
v/c Ratio	0.74	0.47			0.38	0.84	0.48	0.59		0.74	0.31	0.19
Uniform Delay, d1	46.4	43.8			46.1	49.7	55.9	29.3		48.8	18.4	17.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.1	0.4			0.3	22.3	1.6	1.9		9.0	0.5	0.5
Delay (s)	50.5	44.2			46.4	72.1	57.5	31.2		57.8	18.9	17.7
Level of Service	D	D			D	E	E	C		E	B	B
Approach Delay (s)		48.8			66.5			32.4			25.9	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	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)	14	7	160	2	7	0	584	20	10	0	6	27
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	16	8	180	2	8	0	656	22	11	0	7	30
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	8			188			85	52	8	74	231	8
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	8			188			85	52	8	74	231	8
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			24	97	99	100	99	97
cM capacity (veh/h)	1612			1387			861	830	1074	880	661	1074

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	16	8	180	10	690	37
Volume Left	16	0	0	2	656	0
Volume Right	0	0	180	0	11	30
cSH	1612	1700	1700	1387	863	965
Volume to Capacity	0.01	0.00	0.11	0.00	0.80	0.04
Queue Length 95th (ft)	1	0	0	0	214	3
Control Delay (s)	7.3	0.0	0.0	1.7	23.5	8.9
Lane LOS	A			A	C	A
Approach Delay (s)	0.6			1.7	23.5	8.9
Approach LOS					C	A

Intersection Summary			
Average Delay	17.8		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	69	30	124	292	240	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1777	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1777	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	74	32	133	314	258	133
RTOR Reduction (vph)	0	27	0	0	10	0
Lane Group Flow (vph)	74	5	133	314	381	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	7.1	7.1	7.7	32.4	21.7	
Effective Green, g (s)	7.1	7.1	7.7	32.4	21.7	
Actuated g/C Ratio	0.14	0.14	0.16	0.66	0.44	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	256	229	278	1231	786	
v/s Ratio Prot	c0.04	0.00	c0.08	0.17	c0.21	
v/s Ratio Perm						
v/c Ratio	0.29	0.02	0.48	0.26	0.48	
Uniform Delay, d1	18.7	18.0	18.8	3.4	9.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.0	0.5	0.1	0.6	
Delay (s)	19.4	18.0	19.3	3.5	10.2	
Level of Service	B	B	B	A	B	
Approach Delay (s)	19.0			8.2	10.2	
Approach LOS	B			A	B	

Intersection Summary			
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	49.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	206	82	131	225	279	565
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.96		1.00	1.00	0.91	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1729		1770	1863	1694	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1729		1770	1863	1694	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	234	93	149	256	317	642
RTOR Reduction (vph)	20	0	0	0	83	0
Lane Group Flow (vph)	307	0	149	256	876	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	15.7		7.1	38.0	26.9	
Effective Green, g (s)	16.7		6.1	38.5	27.4	
Actuated g/C Ratio	0.27		0.10	0.62	0.44	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	467		174	1162	752	
v/s Ratio Prot	c0.18		c0.08	0.14	c0.52	
v/s Ratio Perm						
v/c Ratio	0.66		0.86	0.22	1.16	
Uniform Delay, d1	20.0		27.4	5.1	17.2	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.5		30.6	0.1	88.2	
Delay (s)	23.4		57.9	5.2	105.3	
Level of Service	C		E	A	F	
Approach Delay (s)	23.4			24.6	105.3	
Approach LOS	C			C	F	

Intersection Summary			
HCM 2000 Control Delay	70.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	61.7	Sum of lost time (s)	11.5
Intersection Capacity Utilization	83.9%	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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	11	204	7	29	264	37	8	74	55	54	9	14
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	13	246	8	35	318	45	10	89	66	65	11	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	267	398	165	93
Volume Left (vph)	13	35	10	65
Volume Right (vph)	8	45	66	17
Hadj (s)	0.02	-0.02	-0.20	0.07
Departure Headway (s)	5.3	5.1	5.6	6.0
Degree Utilization, x	0.39	0.56	0.26	0.16
Capacity (veh/h)	638	681	565	515
Control Delay (s)	11.6	14.3	10.5	10.1
Approach Delay (s)	11.6	14.3	10.5	10.1
Approach LOS	B	B	B	B

Intersection Summary			
Delay	12.4		
Level of Service	B		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	196	459	1307	112	1758	4166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	202	473	1347	115	1812	4295
RTOR Reduction (vph)	0	2	0	16	0	0
Lane Group Flow (vph)	202	471	1347	99	1812	4295
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	8.0	78.5	37.0	107.1	66.5	107.1
Effective Green, g (s)	8.5	79.0	37.5	107.6	67.0	107.6
Actuated g/C Ratio	0.07	0.63	0.30	0.86	0.54	0.86
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	233	2281	1525	1362	1840	4377
v/s Ratio Prot	c0.06	0.13	0.26		0.53	c0.84
v/s Ratio Perm				0.06		
v/c Ratio	0.87	0.21	0.88	0.07	0.98	0.98
Uniform Delay, d1	57.7	9.7	41.7	1.3	28.5	7.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	32.6	0.2	7.8	0.1	17.7	9.9
Delay (s)	90.3	9.9	49.4	1.4	46.2	17.7
Level of Service	F	A	D	A	D	B
Approach Delay (s)	34.0		45.7			26.1
Approach LOS	C		D			C

Intersection Summary			
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.9%	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												
Volume (vph)	388	848	382	1122	3252	14	293	450	377	16	76	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	0.76	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	392	857	386	1133	3285	14	296	455	381	16	77	53
RTOR Reduction (vph)	0	0	147	0	0	6	0	0	323	0	0	49
Lane Group Flow (vph)	392	857	239	1133	3285	8	296	455	58	16	77	4
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	Prot	NA	Prot
Protected Phases	1	6		5	2		7	4	4	3	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	14.6	32.0	32.0	64.9	83.4	83.4	13.4	20.9	20.9	2.4	9.9	9.9
Effective Green, g (s)	15.1	32.5	32.5	65.4	83.9	83.9	13.9	21.4	21.4	2.9	10.4	10.4
Actuated g/C Ratio	0.11	0.23	0.23	0.47	0.60	0.60	0.10	0.15	0.15	0.02	0.07	0.07
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4	4.4	4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2	2.2	2.0	2.0	2.0
Lane Grp Cap (vph)	371	1182	368	1607	3053	950	341	542	552	36	263	117
v/s Ratio Prot	c0.11	0.17		0.33	c0.65		c0.09	c0.13	0.02	0.01	0.02	0.00
v/s Ratio Perm			0.15			0.01						
v/c Ratio	1.06	0.73	0.65	0.71	1.08	0.01	0.87	0.84	0.11	0.44	0.29	0.03
Uniform Delay, d1	62.3	49.5	48.5	29.5	27.9	11.2	62.0	57.5	50.9	67.6	61.2	60.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.4	2.2	4.1	1.2	41.1	0.0	19.7	10.6	0.0	3.2	0.2	0.0
Delay (s)	124.7	51.7	52.6	30.7	69.0	11.2	81.7	68.1	51.0	70.8	61.4	60.0
Level of Service	F	D	D	C	E	B	F	E	D	E	E	E
Approach Delay (s)		69.4			59.0			65.9			61.9	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM 2000 Control Delay	62.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	17.5
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)	46	181	311	299	143	137	165	1312	182	50	1314	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4992		1770	3533	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4992		1770	3533	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	49	195	334	322	154	147	177	1411	196	54	1413	17
RTOR Reduction (vph)	0	0	273	0	0	128	0	12	0	0	1	0
Lane Group Flow (vph)	49	195	61	322	154	19	177	1595	0	54	1429	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	15.1	15.1	15.1	14.1	14.1	14.1	14.1	51.2		6.6	43.7	
Effective Green, g (s)	15.1	15.1	15.1	13.1	13.1	13.1	13.1	52.2		5.6	44.7	
Actuated g/C Ratio	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.51		0.05	0.44	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	262	275	234	440	239	203	227	2554		97	1548	
v/s Ratio Prot	0.03	c0.10	0.04	c0.09	0.08	0.01	c0.10	0.32		0.03	c0.40	
v/s Ratio Perm												
v/c Ratio	0.19	0.71	0.26	0.73	0.64	0.09	0.78	0.62		0.56	0.92	
Uniform Delay, d1	38.1	41.4	38.5	42.8	42.2	39.2	43.1	17.9		47.0	27.0	
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	0.1	6.7	0.2	5.3	4.4	0.1	14.2	1.2		3.9	10.7	
Delay (s)	38.2	48.0	38.7	48.1	46.6	39.3	57.3	19.0		50.9	37.7	
Level of Service	D	D	D	D	D	D	E	B		D	D	
Approach Delay (s)		41.8			45.7			22.8			38.2	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	193	73	85	339	144	115	727	89	124	1065	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3512	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3512	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	52	199	75	88	349	148	119	749	92	128	1098	59
RTOR Reduction (vph)	0	0	65	0	0	114	0	0	53	0	3	0
Lane Group Flow (vph)	52	199	10	78	359	34	119	749	39	128	1154	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	16.5	16.5	16.5	30.3	30.3	30.3	11.6	54.6	54.6	13.1	56.6	
Effective Green, g (s)	16.5	16.5	16.5	30.3	30.3	30.3	11.1	54.6	54.6	12.6	56.1	
Actuated g/C Ratio	0.13	0.13	0.13	0.23	0.23	0.23	0.09	0.42	0.42	0.10	0.43	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	224	236	200	750	394	368	151	1486	664	171	1515	
v/s Ratio Prot	0.03	c0.11	0.01	0.02	c0.21	0.02	0.07	0.21		c0.07	c0.33	
v/s Ratio Perm									0.02			
v/c Ratio	0.23	0.84	0.05	0.10	0.91	0.09	0.79	0.50	0.06	0.75	0.76	
Uniform Delay, d1	51.1	55.5	49.8	39.2	48.5	39.1	58.3	27.7	22.4	57.2	31.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.08	2.59	1.00	1.00	
Incremental Delay, d2	0.2	22.2	0.0	0.0	24.4	0.0	18.4	1.0	0.1	14.4	3.7	
Delay (s)	51.2	77.7	49.9	39.2	72.9	39.1	71.2	30.9	58.1	71.6	35.0	
Level of Service	D	E	D	D	E	D	E	C	E	E	C	
Approach Delay (s)		67.1			59.9			38.5			38.6	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.0%	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)	10	81	382	440	463	567	147	563	295	28	995	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1632		3433	1863	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1632		3433	1863	1583	3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	90	424	489	514	630	163	626	328	31	1106	93
RTOR Reduction (vph)	0	83	0	0	0	144	0	0	0	0	0	63
Lane Group Flow (vph)	11	431	0	489	514	486	163	626	328	31	1106	30
Turn Type	Prot	NA		Prot	NA	Prot	Prot	NA	Over	Prot	NA	Perm
Protected Phases	3	8		7	4	4	5	2	7	1	6	
Permitted Phases												6
Actuated Green, G (s)	2.4	37.4		27.8	62.8	62.8	7.0	43.7	27.8	3.6	41.3	41.3
Effective Green, g (s)	1.9	36.9		28.8	63.8	63.8	7.0	44.7	28.8	3.6	41.3	41.3
Actuated g/C Ratio	0.01	0.28		0.22	0.49	0.49	0.05	0.34	0.22	0.03	0.32	0.32
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	3.0
Lane Grp Cap (vph)	25	463		760	914	776	184	1216	350	49	1124	502
v/s Ratio Prot	0.01	c0.26		0.14	0.28	0.31	c0.05	c0.18	c0.21	0.02	c0.31	
v/s Ratio Perm												0.02
v/c Ratio	0.44	0.93		0.64	0.56	0.63	0.89	0.51	0.94	0.63	0.98	0.06
Uniform Delay, d1	63.5	45.3		45.9	23.3	24.3	61.1	34.0	49.7	62.5	44.0	30.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.05	1.18	0.90	1.36	0.58	0.66
Incremental Delay, d2	4.4	25.2		2.1	1.0	1.8	29.4	0.3	25.4	13.2	19.3	0.2
Delay (s)	68.0	70.5		48.0	24.2	26.1	93.4	40.5	70.1	98.1	45.0	20.6
Level of Service	E	E		D	C	C	F	D	E	F	D	C
Approach Delay (s)		70.5			32.1			56.9			44.5	
Approach LOS		E			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
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)	393	82	39	64	104	515	59	678	28	184	1078	542
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
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.95			1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1773			1828	1583	1770	3518		1770	3539	1583
Flt Permitted	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1773			1828	1583	1770	3518		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	405	85	40	66	107	531	61	699	29	190	1111	559
RTOR Reduction (vph)	0	13	0	0	0	189	0	2	0	0	0	308
Lane Group Flow (vph)	405	112	0	0	173	342	61	726	0	190	1111	251
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	18.1	18.1			31.4	31.4	6.0	47.2		16.7	57.9	57.9
Effective Green, g (s)	18.7	18.7			30.4	30.4	6.5	47.7		17.2	58.4	58.4
Actuated g/C Ratio	0.14	0.14			0.23	0.23	0.05	0.37		0.13	0.45	0.45
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	493	255			427	370	88	1290		234	1589	711
v/s Ratio Prot	c0.12	0.06			0.09	c0.22	0.03	0.21		c0.11	c0.31	
v/s Ratio Perm												0.16
v/c Ratio	0.82	0.44			0.41	0.92	0.69	0.56		0.81	0.70	0.35
Uniform Delay, d1	54.0	50.9			42.1	48.7	60.8	32.8		54.8	28.7	23.4
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		0.80	1.05	4.80
Incremental Delay, d2	10.1	0.4			0.2	27.8	17.3	1.8		9.3	1.2	0.6
Delay (s)	64.1	51.3			42.4	76.5	78.1	34.6		52.9	31.5	113.0
Level of Service	E	D			D	E	E	C		D	C	F
Approach Delay (s)		61.1			68.1			38.0			58.2	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	56.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.7%	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)	13	33	234	49	23	0	178	4	87	3	8	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Frt	1.00	1.00	0.85		1.00			0.96			0.93	
Flt Protected	0.95	1.00	1.00		0.97			0.97			0.99	
Satd. Flow (prot)	1770	1863	1583		1802			1724			1714	
Flt Permitted	0.74	1.00	1.00		0.82			0.79			0.98	
Satd. Flow (perm)	1382	1863	1583		1534			1399			1684	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	15	37	263	55	26	0	200	4	98	3	9	15
RTOR Reduction (vph)	0	0	169	0	0	0	0	22	0	0	7	0
Lane Group Flow (vph)	15	37	94	0	81	0	0	280	0	0	20	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	28.5	28.5	28.5		28.5			42.5			42.5	
Effective Green, g (s)	28.5	28.5	28.5		28.5			42.5			42.5	
Actuated g/C Ratio	0.36	0.36	0.36		0.36			0.53			0.53	
Clearance Time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Grp Cap (vph)	492	663	563		546			743			894	
v/s Ratio Prot		0.02										
v/s Ratio Perm	0.01		c0.06		0.05			c0.20			0.01	
v/c Ratio	0.03	0.06	0.17		0.15			0.38			0.02	
Uniform Delay, d1	16.8	16.9	17.6		17.5			11.0			8.9	
Progression Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2	0.1	0.2	0.6		0.6			1.5			0.0	
Delay (s)	16.9	17.1	18.3		18.1			12.5			8.9	
Level of Service	B	B	B		B			B			A	
Approach Delay (s)		18.1			18.1			12.5			8.9	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	259	98	76	256	268	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.96	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1794	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1794	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	278	105	82	275	288	109
RTOR Reduction (vph)	0	74	0	0	11	0
Lane Group Flow (vph)	278	31	82	275	386	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	16.3	16.3	5.3	29.0	20.7	
Effective Green, g (s)	16.3	16.3	5.3	29.0	20.7	
Actuated g/C Ratio	0.30	0.30	0.10	0.53	0.38	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	526	470	171	985	677	
v/s Ratio Prot	c0.16	0.02	c0.05	0.15	c0.22	
v/s Ratio Perm						
v/c Ratio	0.53	0.07	0.48	0.28	0.57	
Uniform Delay, d1	16.0	13.8	23.4	7.1	13.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	0.1	0.8	0.2	1.3	
Delay (s)	17.1	13.9	24.2	7.3	14.8	
Level of Service	B	B	C	A	B	
Approach Delay (s)	16.2			11.2	14.8	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	54.8	Sum of lost time (s)	12.5
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	562	77	50	515	273	273
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.93	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1755		1770	1863	1737	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1755		1770	1863	1737	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	639	88	57	585	310	310
RTOR Reduction (vph)	7	0	0	0	48	0
Lane Group Flow (vph)	720	0	57	585	572	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	30.1		3.8	33.3	25.5	
Effective Green, g (s)	31.1		2.8	33.8	26.0	
Actuated g/C Ratio	0.44		0.04	0.47	0.36	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	764		69	881	632	
v/s Ratio Prot	c0.41		0.03	c0.31	c0.33	
v/s Ratio Perm						
v/c Ratio	0.94		0.83	0.66	0.90	
Uniform Delay, d1	19.3		34.1	14.4	21.5	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	20.0		50.8	2.0	16.7	
Delay (s)	39.3		84.9	16.4	38.2	
Level of Service	D		F	B	D	
Approach Delay (s)	39.3			22.5	38.2	
Approach LOS	D			C	D	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	71.4	Sum of lost time (s)	11.5
Intersection Capacity Utilization	81.9%	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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	258	8	192	226	126	10	23	59	159	36	30
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	17	311	10	231	272	152	12	28	71	192	43	36

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	337	655	111	271
Volume Left (vph)	17	231	12	192
Volume Right (vph)	10	152	71	36
Hadj (s)	0.03	-0.03	-0.33	0.10
Departure Headway (s)	6.5	6.0	7.3	7.1
Degree Utilization, x	0.61	1.00	0.22	0.53
Capacity (veh/h)	536	655	441	488
Control Delay (s)	19.0	61.1	12.3	17.8
Approach Delay (s)	19.0	61.1	12.3	17.8
Approach LOS	C	F	B	C

Intersection Summary			
Delay	38.3		
Level of Service	E		
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	40	1890	4402	43	819	961
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	41	1948	4538	44	844	991
RTOR Reduction (vph)	0	0	0	4	0	0
Lane Group Flow (vph)	41	1948	4538	40	844	991
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	11.0	61.5	159.0	209.1	46.5	209.1
Effective Green, g (s)	11.5	62.0	159.5	209.6	47.0	209.6
Actuated g/C Ratio	0.05	0.27	0.69	0.91	0.20	0.91
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	171	973	3526	1442	701	4633
v/s Ratio Prot	0.01	c0.54	c0.89		0.25	0.19
v/s Ratio Perm				0.03		
v/c Ratio	0.24	2.00	1.29	0.03	1.20	0.21
Uniform Delay, d1	105.0	84.0	35.2	0.9	91.5	1.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.3	454.6	131.4	0.0	105.0	0.1
Delay (s)	108.3	538.6	166.7	1.0	196.5	1.2
Level of Service	F	F	F	A	F	A
Approach Delay (s)	529.7		165.1			91.1
Approach LOS	F		F			F

Intersection Summary			
HCM 2000 Control Delay	235.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.51		
Actuated Cycle Length (s)	230.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	137.0%	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)	97	2371	107	408	813	5	181	200	1674	187	211	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	0.76	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	98	2395	108	412	821	5	183	202	1691	189	213	212
RTOR Reduction (vph)	0	0	36	0	0	3	0	0	1060	0	0	136
Lane Group Flow (vph)	98	2395	72	412	821	2	183	202	631	189	213	76
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	Prot	NA	Prot
Protected Phases	1	6		5	2		7	4	4	3	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	42.1	59.0	59.0	19.6	37.6	37.6	10.0	10.6	10.6	13.5	14.1	14.1
Effective Green, g (s)	42.6	59.5	59.5	20.1	38.1	38.1	10.5	11.1	11.1	14.0	14.6	14.6
Actuated g/C Ratio	0.35	0.49	0.49	0.16	0.31	0.31	0.09	0.09	0.09	0.11	0.12	0.12
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4	4.4	4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2	2.2	2.0	2.0	2.0
Lane Grp Cap (vph)	1196	2475	770	564	1585	493	294	321	327	202	422	189
v/s Ratio Prot	0.03	c0.47		c0.12	0.16		0.05	0.06	c0.17	c0.11	c0.06	0.05
v/s Ratio Perm			0.05			0.00						
v/c Ratio	0.08	0.97	0.09	0.73	0.52	0.00	0.62	0.63	1.93	0.94	0.50	0.40
Uniform Delay, d1	26.7	30.4	16.9	48.5	34.5	29.0	53.9	53.6	55.6	53.7	50.4	49.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	11.4	0.1	4.2	0.3	0.0	3.2	3.0	429.4	44.6	0.3	0.5
Delay (s)	26.7	41.8	16.9	52.7	34.8	29.0	57.1	56.6	484.9	98.2	50.8	50.3
Level of Service	C	D	B	D	C	C	E	E	F	F	D	D
Approach Delay (s)		40.2			40.7			405.5			65.2	
Approach LOS		D			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	158.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	122.2	Sum of lost time (s)	17.5
Intersection Capacity Utilization	106.5%	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)	55	134	226	194	229	87	299	1456	259	68	912	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	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4970		1770	3500	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4970		1770	3500	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	59	144	243	209	246	94	322	1566	278	73	981	78
RTOR Reduction (vph)	0	0	218	0	0	80	0	22	0	0	5	0
Lane Group Flow (vph)	59	144	25	209	246	14	322	1822	0	73	1054	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.3	10.3	10.3	16.4	16.4	16.4	21.6	53.2		7.1	38.7	
Effective Green, g (s)	10.3	10.3	10.3	15.4	15.4	15.4	20.6	54.2		6.1	39.7	
Actuated g/C Ratio	0.10	0.10	0.10	0.15	0.15	0.15	0.20	0.53		0.06	0.39	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	178	188	159	518	281	239	357	2640		105	1362	
v/s Ratio Prot	0.03	c0.08	0.02	0.06	c0.13	0.01	c0.18	0.37		0.04	c0.30	
v/s Ratio Perm												
v/c Ratio	0.33	0.77	0.15	0.40	0.88	0.06	0.90	0.69		0.70	0.77	
Uniform Delay, d1	42.6	44.7	41.9	39.1	42.4	37.1	39.7	17.7		47.0	27.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	15.3	0.2	0.2	24.1	0.0	24.5	1.5		14.9	4.3	
Delay (s)	43.0	60.0	42.0	39.3	66.5	37.1	64.2	19.2		61.9	31.6	
Level of Service	D	E	D	D	E	D	E	B		E	C	
Approach Delay (s)		48.0			51.1			25.9			33.5	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.8%	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)	143	242	110	193	226	408	59	1080	107	406	785	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3497	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3497	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	147	249	113	199	233	421	61	1113	110	419	809	70
RTOR Reduction (vph)	0	0	97	0	0	345	0	0	67	0	5	0
Lane Group Flow (vph)	147	249	16	177	255	76	61	1113	43	419	874	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	18.1	18.1	18.1	20.0	20.0	20.0	7.1	44.4	44.4	32.0	69.8	
Effective Green, g (s)	18.1	18.1	18.1	20.0	20.0	20.0	6.6	44.4	44.4	31.5	69.3	
Actuated g/C Ratio	0.14	0.14	0.14	0.15	0.15	0.15	0.05	0.34	0.34	0.24	0.53	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	246	259	220	495	259	243	89	1208	540	428	1864	
v/s Ratio Prot	0.08	c0.13	0.01	0.05	c0.15	0.05	0.03	c0.31		c0.24	0.25	
v/s Ratio Perm									0.03			
v/c Ratio	0.60	0.96	0.07	0.36	0.98	0.31	0.69	0.92	0.08	0.98	0.47	
Uniform Delay, d1	52.5	55.6	48.6	49.2	54.8	48.9	60.7	41.1	29.0	48.9	18.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.23	0.85	0.74	1.00	1.00	
Incremental Delay, d2	2.6	44.8	0.1	0.2	51.1	0.3	13.1	10.8	0.2	37.4	0.9	
Delay (s)	55.1	100.4	48.7	49.4	106.0	49.2	87.7	45.9	21.6	86.3	19.7	
Level of Service	E	F	D	D	F	D	F	D	C	F	B	
Approach Delay (s)		75.9			66.2			45.8			41.2	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	52.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	96	228	323	646	566	568	585	684	61	975	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1666		3433	1863	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1666		3433	1863	1583	3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	19	107	253	359	718	629	631	650	760	68	1083	162
RTOR Reduction (vph)	0	64	0	0	0	171	0	0	0	0	0	117
Lane Group Flow (vph)	19	296	0	359	718	458	631	650	760	68	1083	45
Turn Type	Prot	NA		Prot	NA	Prot	Prot	NA	Over	Prot	NA	Perm
Protected Phases	3	8		7	4	4	5	2	7	1	6	
Permitted Phases												6
Actuated Green, G (s)	2.4	17.6		46.0	61.2	61.2	18.0	41.5	46.0	7.4	31.9	31.9
Effective Green, g (s)	1.9	17.1		47.0	62.2	62.2	18.0	42.5	47.0	7.4	31.9	31.9
Actuated g/C Ratio	0.01	0.13		0.36	0.48	0.48	0.14	0.33	0.36	0.06	0.25	0.25
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	3.0
Lane Grp Cap (vph)	25	219		1241	891	757	475	1156	572	100	868	388
v/s Ratio Prot	0.01	c0.18		0.10	0.39	0.29	c0.18	0.18	c0.48	0.04	c0.31	
v/s Ratio Perm												0.03
v/c Ratio	0.76	1.35		0.29	0.81	0.61	1.33	0.56	1.33	0.68	1.25	0.12
Uniform Delay, d1	63.8	56.5		29.6	28.8	24.9	56.0	36.1	41.5	60.1	49.0	38.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.19	2.79
Incremental Delay, d2	75.2	184.7		0.2	5.7	1.6	161.8	0.8	159.7	13.3	120.6	0.6
Delay (s)	139.1	241.2		29.8	34.4	26.5	217.8	36.8	201.2	67.2	178.8	106.9
Level of Service	F	F		C	C	C	F	D	F	E	F	F
Approach Delay (s)		236.0			30.5			154.0			164.1	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	123.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.5%	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)	450	127	61	21	95	372	38	775	86	340	520	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	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.95			1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1772			1846	1583	1770	3486		1770	3539	1583
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1772			1846	1583	1770	3486		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	464	131	63	22	98	384	39	799	89	351	536	296
RTOR Reduction (vph)	0	14	0	0	0	332	0	6	0	0	0	131
Lane Group Flow (vph)	464	180	0	0	120	52	39	882	0	351	536	165
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	19.6	19.6			12.3	12.3	5.0	44.7		26.8	66.5	66.5
Effective Green, g (s)	20.2	20.2			11.3	11.3	5.5	45.2		27.3	67.0	67.0
Actuated g/C Ratio	0.17	0.17			0.09	0.09	0.05	0.38		0.23	0.56	0.56
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	577	298			173	149	81	1313		402	1975	883
v/s Ratio Prot	c0.14	0.10			c0.07	0.03	0.02	c0.25		c0.20	0.15	
v/s Ratio Perm												0.10
v/c Ratio	0.80	0.60			0.69	0.35	0.48	0.67		0.87	0.27	0.19
Uniform Delay, d1	48.0	46.2			52.7	50.9	55.9	31.2		44.7	13.8	13.1
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.6	2.4			9.3	0.5	1.6	2.8		18.0	0.3	0.5
Delay (s)	55.5	48.6			62.0	51.4	57.5	34.0		62.6	14.1	13.5
Level of Service	E	D			E	D	E	C		E	B	B
Approach Delay (s)		53.5			53.9			34.9			28.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱		✣			✣			✣	
Volume (vph)	14	13	160	84	13	0	584	20	38	0	6	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Frt	1.00	1.00	0.85		1.00			0.99			0.89	
Flt Protected	0.95	1.00	1.00		0.96			0.96			1.00	
Satd. Flow (prot)	1770	1863	1583		1786			1767			1659	
Flt Permitted	0.72	1.00	1.00		0.75			0.72			1.00	
Satd. Flow (perm)	1345	1863	1583		1393			1327			1659	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	16	15	180	94	15	0	656	22	43	0	7	30
RTOR Reduction (vph)	0	0	138	0	0	0	0	3	0	0	10	0
Lane Group Flow (vph)	16	15	42	0	109	0	0	718	0	0	27	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	18.5	18.5	18.5		18.5			52.5			52.5	
Effective Green, g (s)	18.5	18.5	18.5		18.5			52.5			52.5	
Actuated g/C Ratio	0.23	0.23	0.23		0.23			0.66			0.66	
Clearance Time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Grp Cap (vph)	311	430	366		322			870			1088	
v/s Ratio Prot		0.01									0.02	
v/s Ratio Perm	0.01		0.03		c0.08			c0.54				
v/c Ratio	0.05	0.03	0.11		0.34			0.83			0.02	
Uniform Delay, d1	23.9	23.8	24.3		25.6			10.3			4.8	
Progression Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2	0.3	0.2	0.6		2.8			8.8			0.0	
Delay (s)	24.2	24.0	24.9		28.5			19.1			4.8	
Level of Service	C	C	C		C			B			A	
Approach Delay (s)		24.8			28.5			19.1			4.8	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	275	32	124	378	245	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1753	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1753	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	296	34	133	406	263	203
RTOR Reduction (vph)	0	25	0	0	15	0
Lane Group Flow (vph)	296	9	133	406	451	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	18.8	18.8	8.9	43.0	31.1	
Effective Green, g (s)	18.8	18.8	8.9	43.0	31.1	
Actuated g/C Ratio	0.26	0.26	0.12	0.60	0.44	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	466	417	220	1123	764	
v/s Ratio Prot	c0.17	0.01	c0.08	0.22	c0.26	
v/s Ratio Perm						
v/c Ratio	0.64	0.02	0.60	0.36	0.59	
Uniform Delay, d1	23.2	19.4	29.5	7.2	15.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.0	0.0	3.2	0.2	1.3	
Delay (s)	26.2	19.5	32.7	7.4	16.6	
Level of Service	C	B	C	A	B	
Approach Delay (s)	25.5			13.7	16.6	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	12.5
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
9: E Bayshore Rd/E BayshoreRd & Pulgas Ave

1/15/2016

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	308	82	134	516	352	575
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.97		1.00	1.00	0.92	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1741		1770	1863	1707	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1741		1770	1863	1707	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	350	93	152	586	400	653
RTOR Reduction (vph)	12	0	0	0	78	0
Lane Group Flow (vph)	431	0	152	586	975	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	16.0		7.0	51.0	40.0	
Effective Green, g (s)	17.0		6.0	51.5	40.5	
Actuated g/C Ratio	0.23		0.08	0.69	0.54	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	394		141	1279	921	
v/s Ratio Prot	c0.25		c0.09	0.31	c0.57	
v/s Ratio Perm						
v/c Ratio	1.09		1.08	0.46	1.06	
Uniform Delay, d1	29.0		34.5	5.4	17.2	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	72.7		98.2	0.3	46.4	
Delay (s)	101.7		132.7	5.7	63.6	
Level of Service	F		F	A	E	
Approach Delay (s)	101.7			31.8	63.6	
Approach LOS	F			C	E	

Intersection Summary			
HCM 2000 Control Delay	60.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	94.1%	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)	11	205	7	173	264	93	8	75	152	66	9	14
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	13	247	8	208	318	112	10	90	183	80	11	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	269	639	283	107
Volume Left (vph)	13	208	10	80
Volume Right (vph)	8	112	183	17
Hadj (s)	0.03	-0.01	-0.35	0.09
Departure Headway (s)	6.4	5.8	6.4	7.4
Degree Utilization, x	0.48	1.00	0.50	0.22
Capacity (veh/h)	535	639	533	447
Control Delay (s)	15.2	60.0	15.8	12.5
Approach Delay (s)	15.2	60.0	15.8	12.5
Approach LOS	C	F	C	B

Intersection Summary			
Delay	37.2		
Level of Service	E		
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	196	469	1327	112	1752	4155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	202	484	1368	115	1806	4284
RTOR Reduction (vph)	0	1	0	16	0	0
Lane Group Flow (vph)	202	483	1368	99	1806	4284
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	8.0	78.5	37.0	107.1	66.5	107.1
Effective Green, g (s)	8.5	79.0	37.5	107.6	67.0	107.6
Actuated g/C Ratio	0.07	0.63	0.30	0.86	0.54	0.86
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	233	2281	1525	1362	1840	4377
v/s Ratio Prot	c0.06	0.13	0.27		0.53	c0.84
v/s Ratio Perm				0.06		
v/c Ratio	0.87	0.21	0.90	0.07	0.98	0.98
Uniform Delay, d1	57.7	9.8	41.9	1.3	28.4	7.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	32.6	0.2	8.7	0.1	17.0	9.5
Delay (s)	90.3	10.0	50.6	1.4	45.4	17.2
Level of Service	F	A	D	A	D	B
Approach Delay (s)	33.6		46.8			25.6
Approach LOS	C		D			C

Intersection Summary			
HCM 2000 Control Delay	30.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.7%	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												
Volume (vph)	382	852	413	1074	3292	14	332	447	382	16	74	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	0.76	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	386	861	417	1085	3325	14	335	452	386	16	75	54
RTOR Reduction (vph)	0	0	164	0	0	6	0	0	325	0	0	50
Lane Group Flow (vph)	386	861	253	1085	3325	8	335	452	61	16	75	4
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	Prot	NA	Prot
Protected Phases	1	6		5	2		7	4	4	3	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	14.5	33.1	33.1	63.8	83.5	83.5	15.2	21.5	21.5	2.4	8.7	8.7
Effective Green, g (s)	15.0	33.6	33.6	64.3	84.0	84.0	15.7	22.0	22.0	2.9	9.2	9.2
Actuated g/C Ratio	0.11	0.24	0.24	0.46	0.60	0.60	0.11	0.16	0.16	0.02	0.07	0.07
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4	4.4	4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2	2.2	2.0	2.0	2.0
Lane Grp Cap (vph)	367	1217	379	1573	3044	947	384	554	566	36	232	103
v/s Ratio Prot	c0.11	0.17		0.32	c0.65		c0.10	c0.13	0.02	0.01	0.02	0.00
v/s Ratio Perm			0.16			0.01						
v/c Ratio	1.05	0.71	0.67	0.69	1.09	0.01	0.87	0.82	0.11	0.44	0.32	0.03
Uniform Delay, d1	62.7	48.9	48.3	30.1	28.2	11.4	61.3	57.2	50.7	67.9	62.6	61.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	61.2	1.9	4.4	1.0	47.6	0.0	18.7	8.7	0.0	3.2	0.3	0.0
Delay (s)	123.9	50.8	52.7	31.1	75.8	11.4	80.0	65.9	50.8	71.1	62.9	61.4
Level of Service	F	D	D	C	E	B	F	E	D	E	E	E
Approach Delay (s)		68.2			64.6			64.9			63.2	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM 2000 Control Delay	65.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.3	Sum of lost time (s)	17.5
Intersection Capacity Utilization	101.9%	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)	79	181	311	299	143	189	165	1336	182	52	1338	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	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4994		1770	3530	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4994		1770	3530	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	85	195	334	322	154	203	177	1437	196	56	1439	25
RTOR Reduction (vph)	0	0	273	0	0	177	0	12	0	0	1	0
Lane Group Flow (vph)	85	195	61	322	154	26	177	1621	0	56	1463	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	15.2	15.2	15.2	14.1	14.1	14.1	14.1	51.0		6.7	43.6	
Effective Green, g (s)	15.2	15.2	15.2	13.1	13.1	13.1	13.1	52.0		5.7	44.6	
Actuated g/C Ratio	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.51		0.06	0.44	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	263	277	235	440	239	203	227	2545		98	1543	
v/s Ratio Prot	0.05	c0.10	0.04	c0.09	0.08	0.02	c0.10	0.32		0.03	c0.41	
v/s Ratio Perm												
v/c Ratio	0.32	0.70	0.26	0.73	0.64	0.13	0.78	0.64		0.57	0.95	
Uniform Delay, d1	38.8	41.3	38.4	42.8	42.2	39.4	43.1	18.1		47.0	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	0.3	6.5	0.2	5.3	4.4	0.1	14.2	1.2		4.9	13.5	
Delay (s)	39.1	47.7	38.6	48.1	46.6	39.5	57.3	19.4		51.9	41.1	
Level of Service	D	D	D	D	D	D	E	B		D	D	
Approach Delay (s)		41.6			45.2			23.1			41.5	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.2%	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)	49	193	73	78	378	166	114	742	89	126	1045	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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	51	199	75	80	390	171	118	765	92	130	1077	75
RTOR Reduction (vph)	0	0	65	0	0	127	0	0	55	0	4	0
Lane Group Flow (vph)	51	199	10	71	399	44	118	765	37	130	1148	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	16.5	16.5	16.5	33.2	33.2	33.2	11.4	51.6	51.6	13.2	53.9	
Effective Green, g (s)	16.5	16.5	16.5	33.2	33.2	33.2	10.9	51.6	51.6	12.7	53.4	
Actuated g/C Ratio	0.13	0.13	0.13	0.26	0.26	0.26	0.08	0.40	0.40	0.10	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	224	236	200	822	432	404	148	1404	628	172	1439	
v/s Ratio Prot	0.03	c0.11	0.01	0.02	c0.24	0.03	0.07	0.22		c0.07	c0.33	
v/s Ratio Perm									0.02			
v/c Ratio	0.23	0.84	0.05	0.09	0.92	0.11	0.80	0.54	0.06	0.76	0.80	
Uniform Delay, d1	51.0	55.5	49.8	36.9	47.2	37.1	58.5	30.2	24.2	57.1	33.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.32	0.88	0.65	1.00	1.00	
Incremental Delay, d2	0.2	22.2	0.0	0.0	25.0	0.0	19.8	1.2	0.1	15.3	4.7	
Delay (s)	51.2	77.7	49.9	36.9	72.1	37.1	97.1	27.7	15.8	72.5	38.3	
Level of Service	D	E	D	D	E	D	F	C	B	E	D	
Approach Delay (s)		67.1			58.9			35.0			41.7	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	45.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
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)	10	81	382	435	463	578	150	576	303	28	1008	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1632		3433	1863	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1632		3433	1863	1583	3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	90	424	483	514	642	167	640	337	31	1120	93
RTOR Reduction (vph)	0	83	0	0	0	141	0	0	0	0	0	63
Lane Group Flow (vph)	11	431	0	483	514	501	167	640	337	31	1120	30
Turn Type	Prot	NA		Prot	NA	Prot	Prot	NA	Over	Prot	NA	Perm
Protected Phases	3	8		7	4	4	5	2	7	1	6	
Permitted Phases												6
Actuated Green, G (s)	2.4	37.0		28.1	62.7	62.7	7.0	43.8	28.1	3.6	41.4	41.4
Effective Green, g (s)	1.9	36.5		29.1	63.7	63.7	7.0	44.8	29.1	3.6	41.4	41.4
Actuated g/C Ratio	0.01	0.28		0.22	0.49	0.49	0.05	0.34	0.22	0.03	0.32	0.32
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	3.0
Lane Grp Cap (vph)	25	458		768	912	775	184	1219	354	49	1127	504
v/s Ratio Prot	0.01	c0.26		0.14	0.28	0.32	c0.05	c0.18	c0.21	0.02	c0.32	
v/s Ratio Perm												0.02
v/c Ratio	0.44	0.94		0.63	0.56	0.65	0.91	0.53	0.95	0.63	0.99	0.06
Uniform Delay, d1	63.5	45.7		45.6	23.4	24.7	61.2	34.1	49.8	62.5	44.2	30.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.05	1.18	0.90	0.59	1.35	7.87
Incremental Delay, d2	4.4	27.3		1.8	1.0	2.1	33.8	0.4	28.6	12.7	20.8	0.2
Delay (s)	68.0	73.0		47.4	24.3	26.8	98.1	40.6	73.5	49.8	80.4	242.3
Level of Service	E	E		D	C	C	F	D	E	D	F	F
Approach Delay (s)		72.9			32.1			58.7			91.7	
Approach LOS		E			C			E			F	

Intersection Summary			
HCM 2000 Control Delay	59.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.4%	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)	393	77	46	69	107	503	59	682	25	184	1078	542
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
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.94			1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1759			1827	1583	1770	3520		1770	3539	1583
Flt Permitted	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1759			1827	1583	1770	3520		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	405	79	47	71	110	519	61	703	26	190	1111	559
RTOR Reduction (vph)	0	16	0	0	0	191	0	2	0	0	0	304
Lane Group Flow (vph)	405	110	0	0	181	328	61	727	0	190	1111	255
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	18.1	18.1			30.5	30.5	6.0	48.1		16.7	58.8	58.8
Effective Green, g (s)	18.7	18.7			29.5	29.5	6.5	48.6		17.2	59.3	59.3
Actuated g/C Ratio	0.14	0.14			0.23	0.23	0.05	0.37		0.13	0.46	0.46
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	493	253			414	359	88	1315		234	1614	722
v/s Ratio Prot	c0.12	0.06			0.10	c0.21	0.03	0.21		c0.11	c0.31	
v/s Ratio Perm												0.16
v/c Ratio	0.82	0.43			0.44	0.91	0.69	0.55		0.81	0.69	0.35
Uniform Delay, d1	54.0	50.8			43.1	49.0	60.8	32.1		54.8	28.0	22.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		0.80	1.06	4.79
Incremental Delay, d2	10.1	0.4			0.3	26.5	17.3	1.7		9.0	1.1	0.6
Delay (s)	64.1	51.3			43.4	75.5	78.1	33.8		52.9	30.9	110.4
Level of Service	E	D			D	E	E	C		D	C	F
Approach Delay (s)		61.1			67.2			37.2			57.0	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	55.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.0%	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)	13	32	234	50	22	0	178	4	87	3	8	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Frt	1.00	1.00	0.85		1.00			0.96			0.93	
Flt Protected	0.95	1.00	1.00		0.97			0.97			0.99	
Satd. Flow (prot)	1770	1863	1583		1801			1724			1714	
Flt Permitted	0.74	1.00	1.00		0.82			0.79			0.98	
Satd. Flow (perm)	1381	1863	1583		1528			1399			1684	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	15	36	263	56	25	0	200	4	98	3	9	15
RTOR Reduction (vph)	0	0	169	0	0	0	0	22	0	0	7	0
Lane Group Flow (vph)	15	36	94	0	81	0	0	280	0	0	20	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	28.5	28.5	28.5		28.5			42.5			42.5	
Effective Green, g (s)	28.5	28.5	28.5		28.5			42.5			42.5	
Actuated g/C Ratio	0.36	0.36	0.36		0.36			0.53			0.53	
Clearance Time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Grp Cap (vph)	491	663	563		544			743			894	
v/s Ratio Prot		0.02										
v/s Ratio Perm	0.01		c0.06		0.05			c0.20			0.01	
v/c Ratio	0.03	0.05	0.17		0.15			0.38			0.02	
Uniform Delay, d1	16.8	16.9	17.6		17.5			11.0			8.9	
Progression Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2	0.1	0.2	0.6		0.6			1.5			0.0	
Delay (s)	16.9	17.1	18.3		18.1			12.5			8.9	
Level of Service	B	B	B		B			B			A	
Approach Delay (s)		18.1			18.1			12.5			8.9	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	299	119	80	233	286	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.95	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1774	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1774	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	322	128	86	251	308	167
RTOR Reduction (vph)	0	93	0	0	10	0
Lane Group Flow (vph)	322	35	86	251	465	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	19.3	19.3	5.7	41.4	32.7	
Effective Green, g (s)	19.3	19.3	5.7	41.4	32.7	
Actuated g/C Ratio	0.27	0.27	0.08	0.59	0.47	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	486	435	143	1098	826	
v/s Ratio Prot	c0.18	0.02	c0.05	0.13	c0.26	
v/s Ratio Perm						
v/c Ratio	0.66	0.08	0.60	0.23	0.56	
Uniform Delay, d1	22.6	18.9	31.2	6.8	13.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.5	0.1	4.8	0.1	1.0	
Delay (s)	26.1	19.0	36.0	7.0	14.5	
Level of Service	C	B	D	A	B	
Approach Delay (s)	24.1			14.4	14.5	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.2	Sum of lost time (s)	12.5
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	557	77	50	530	312	269
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.94	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1755		1770	1863	1746	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1755		1770	1863	1746	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	633	88	57	602	355	306
RTOR Reduction (vph)	6	0	0	0	42	0
Lane Group Flow (vph)	715	0	57	602	619	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	30.2		3.8	34.7	26.9	
Effective Green, g (s)	31.2		2.8	35.2	27.4	
Actuated g/C Ratio	0.43		0.04	0.48	0.38	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	751		67	899	656	
v/s Ratio Prot	c0.41		0.03	c0.32	c0.35	
v/s Ratio Perm						
v/c Ratio	0.95		0.85	0.67	0.94	
Uniform Delay, d1	20.1		34.8	14.4	22.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	21.9		59.3	2.0	22.4	
Delay (s)	42.0		94.2	16.4	44.4	
Level of Service	D		F	B	D	
Approach Delay (s)	42.0			23.1	44.4	
Approach LOS	D			C	D	

Intersection Summary			
HCM 2000 Control Delay	36.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	72.9	Sum of lost time (s)	11.5
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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	257	9	213	226	142	11	31	88	124	35	30
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	17	310	11	257	272	171	13	37	106	149	42	36

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	337	700	157	228
Volume Left (vph)	17	257	13	149
Volume Right (vph)	11	171	106	36
Hadj (s)	0.02	-0.04	-0.36	0.07
Departure Headway (s)	6.5	6.0	7.1	7.2
Degree Utilization, x	0.61	1.00	0.31	0.45
Capacity (veh/h)	532	700	461	472
Control Delay (s)	19.1	61.0	13.2	16.1
Approach Delay (s)	19.1	61.0	13.2	16.1
Approach LOS	C	F	B	C

Intersection Summary			
Delay	38.6		
Level of Service	E		
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Volume (vph)	40	1897	4385	43	798	995
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5	5.5	5.4	3.0	5.4
Lane Util. Factor	0.97	0.76	0.91	1.00	0.97	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	3610	5085	1583	3433	5085
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3610	5085	1583	3433	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	41	1956	4521	44	823	1026
RTOR Reduction (vph)	0	0	0	4	0	0
Lane Group Flow (vph)	41	1956	4521	40	823	1026
Turn Type	Prot	pt+ov	NA	custom	Prot	NA
Protected Phases	4	4 5	6		5	2
Permitted Phases				2		
Actuated Green, G (s)	11.0	61.5	159.0	209.1	46.5	209.1
Effective Green, g (s)	11.5	62.0	159.5	209.6	47.0	209.6
Actuated g/C Ratio	0.05	0.27	0.69	0.91	0.20	0.91
Clearance Time (s)	4.0		6.0	5.9	3.5	5.9
Lane Grp Cap (vph)	171	973	3526	1442	701	4633
v/s Ratio Prot	0.01	c0.54	c0.89		0.24	0.20
v/s Ratio Perm				0.03		
v/c Ratio	0.24	2.01	1.28	0.03	1.17	0.22
Uniform Delay, d1	105.0	84.0	35.2	0.9	91.5	1.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.3	458.3	129.3	0.0	92.9	0.1
Delay (s)	108.3	542.3	164.5	1.0	184.4	1.2
Level of Service	F	F	F	A	F	A
Approach Delay (s)	533.4		162.9			82.8
Approach LOS	F		F			F

Intersection Summary			
HCM 2000 Control Delay	233.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.51		
Actuated Cycle Length (s)	230.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	136.9%	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)	100	2384	132	408	848	5	187	202	1646	187	211	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	5.5	5.5	4.1	5.5	5.5	3.9	3.9	3.9	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	0.76	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	3433	3539	3610	1770	3539	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	101	2408	133	412	857	5	189	204	1663	189	213	190
RTOR Reduction (vph)	0	0	36	0	0	4	0	0	1059	0	0	122
Lane Group Flow (vph)	101	2408	97	412	857	1	189	204	604	189	213	68
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	Prot	NA	Prot
Protected Phases	1	6		5	2		7	4	4	3	8	8
Permitted Phases			6			2						
Actuated Green, G (s)	52.5	59.0	59.0	18.9	26.5	26.5	10.2	10.7	10.7	13.5	14.0	14.0
Effective Green, g (s)	53.0	59.5	59.5	19.4	27.0	27.0	10.7	11.2	11.2	14.0	14.5	14.5
Actuated g/C Ratio	0.44	0.49	0.49	0.16	0.22	0.22	0.09	0.09	0.09	0.12	0.12	0.12
Clearance Time (s)	3.5	6.0	6.0	4.6	6.0	6.0	4.4	4.4	4.4	4.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.2	2.2	2.2	2.0	2.0	2.0
Lane Grp Cap (vph)	1496	2488	774	547	1129	351	302	325	332	203	422	188
v/s Ratio Prot	0.03	c0.47		c0.12	0.17		0.06	0.06	c0.17	c0.11	c0.06	0.04
v/s Ratio Perm			0.06			0.00						
v/c Ratio	0.07	0.97	0.13	0.75	0.76	0.00	0.63	0.63	1.82	0.93	0.50	0.36
Uniform Delay, d1	19.9	30.1	16.9	48.8	44.3	36.8	53.5	53.2	55.2	53.3	50.2	49.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	11.4	0.1	5.2	3.0	0.0	3.1	2.9	380.9	43.5	0.3	0.4
Delay (s)	19.9	41.5	17.0	54.0	47.2	36.8	56.6	56.1	436.1	96.9	50.5	49.7
Level of Service	B	D	B	D	D	D	E	E	F	F	D	D
Approach Delay (s)		39.5			49.4			363.5			65.1	
Approach LOS		D			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	145.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	121.6	Sum of lost time (s)	17.5
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)	51	134	226	194	237	93	288	1449	259	68	912	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3433	1863	1583	1770	4970		1770	3504	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3433	1863	1583	1770	4970		1770	3504	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	55	144	243	209	255	100	310	1558	278	73	981	69
RTOR Reduction (vph)	0	0	218	0	0	84	0	22	0	0	5	0
Lane Group Flow (vph)	55	144	25	209	255	16	310	1814	0	73	1045	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA		Prot	NA	
Protected Phases	4	4	4	3	3	3	5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	10.3	10.3	10.3	17.1	17.1	17.1	20.8	52.5		7.1	38.8	
Effective Green, g (s)	10.3	10.3	10.3	16.1	16.1	16.1	19.8	53.5		6.1	39.8	
Actuated g/C Ratio	0.10	0.10	0.10	0.16	0.16	0.16	0.19	0.52		0.06	0.39	
Clearance Time (s)	4.0	4.0	4.0	3.0	3.0	3.0	3.0	5.0		3.0	5.0	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	178	188	159	541	294	249	343	2606		105	1367	
v/s Ratio Prot	0.03	c0.08	0.02	0.06	c0.14	0.01	c0.18	0.36		0.04	c0.30	
v/s Ratio Perm												
v/c Ratio	0.31	0.77	0.15	0.39	0.87	0.06	0.90	0.70		0.70	0.76	
Uniform Delay, d1	42.5	44.7	41.9	38.5	41.9	36.5	40.2	18.2		47.0	27.0	
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	0.4	15.3	0.2	0.2	21.9	0.0	25.5	1.6		14.9	4.1	
Delay (s)	42.9	60.0	42.0	38.7	63.8	36.6	65.6	19.7		61.9	31.1	
Level of Service	D	E	D	D	E	D	E	B		E	C	
Approach Delay (s)		48.0			49.7			26.4			33.1	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.3%	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)	143	277	110	215	268	412	58	1090	115	442	739	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3495	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3495	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	147	286	113	222	276	425	60	1124	119	456	762	70
RTOR Reduction (vph)	0	0	96	0	0	350	0	0	68	0	5	0
Lane Group Flow (vph)	147	286	17	198	300	75	60	1124	51	456	827	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	19.0	19.0	19.0	21.0	21.0	21.0	7.1	42.0	42.0	32.5	67.9	
Effective Green, g (s)	19.0	19.0	19.0	21.0	21.0	21.0	6.6	42.0	42.0	32.0	67.4	
Actuated g/C Ratio	0.15	0.15	0.15	0.16	0.16	0.16	0.05	0.32	0.32	0.25	0.52	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	258	272	231	520	272	255	89	1143	511	435	1812	
v/s Ratio Prot	0.08	c0.15	0.01	0.06	c0.18	0.05	0.03	c0.32		c0.26	0.24	
v/s Ratio Perm									0.03			
v/c Ratio	0.57	1.05	0.07	0.38	1.10	0.29	0.67	0.98	0.10	1.05	0.46	
Uniform Delay, d1	51.7	55.5	47.9	48.7	54.5	48.0	60.6	43.7	30.8	49.0	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.27	0.84	0.71	1.00	1.00	
Incremental Delay, d2	1.7	68.7	0.0	0.2	85.0	0.2	11.9	20.1	0.3	56.4	0.8	
Delay (s)	53.4	124.2	47.9	48.9	139.5	48.2	88.7	56.7	22.2	105.4	20.6	
Level of Service	D	F	D	D	F	D	F	E	C	F	C	
Approach Delay (s)		89.4			78.0			55.0			50.6	
Approach LOS		F			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	63.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	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)	17	96	238	378	646	566	577	610	684	61	945	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1664		3433	1863	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1664		3433	1863	1583	3433	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	19	107	264	420	718	629	641	678	760	68	1050	162
RTOR Reduction (vph)	0	67	0	0	0	166	0	0	0	0	0	118
Lane Group Flow (vph)	19	304	0	420	718	463	641	678	760	68	1050	44
Turn Type	Prot	NA		Prot	NA	Prot	Prot	NA	Over	Prot	NA	Perm
Protected Phases	3	8		7	4	4	5	2	7	1	6	
Permitted Phases												6
Actuated Green, G (s)	2.4	18.6		46.0	62.2	62.2	18.0	40.5	46.0	7.4	30.9	30.9
Effective Green, g (s)	1.9	18.1		47.0	63.2	63.2	18.0	41.5	47.0	7.4	30.9	30.9
Actuated g/C Ratio	0.01	0.14		0.36	0.49	0.49	0.14	0.32	0.36	0.06	0.24	0.24
Clearance Time (s)	3.5	3.5		5.0	5.0	5.0	4.0	5.0	5.0	4.0	4.0	4.0
Vehicle Extension (s)	2.0	2.0		4.0	4.0	4.0	5.0	4.0	4.0	2.0	3.0	3.0
Lane Grp Cap (vph)	25	231		1241	905	769	475	1129	572	100	841	376
v/s Ratio Prot	0.01	c0.18		0.12	0.39	0.29	c0.19	0.19	c0.48	0.04	c0.30	
v/s Ratio Perm												0.03
v/c Ratio	0.76	1.32		0.34	0.79	0.60	1.35	0.60	1.33	0.68	1.25	0.12
Uniform Delay, d1	63.8	56.0		30.2	27.9	24.3	56.0	37.3	41.5	60.1	49.6	38.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.13	2.58
Incremental Delay, d2	75.2	169.2		0.2	5.1	1.5	170.7	1.0	159.7	13.3	121.2	0.6
Delay (s)	139.1	225.1		30.4	33.0	25.8	226.7	38.3	201.2	67.6	177.3	101.0
Level of Service	F	F		C	C	C	F	D	F	E	F	F
Approach Delay (s)		221.0			29.8			156.0			161.8	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	121.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.9%	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												
Volume (vph)	450	121	61	15	121	360	65	775	58	357	520	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	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00			1.00	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.95			1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1769			1853	1583	1770	3502		1770	3539	1583
Flt Permitted	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1769			1853	1583	1770	3502		1770	3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	464	125	63	15	125	371	67	799	60	368	536	296
RTOR Reduction (vph)	0	15	0	0	0	330	0	4	0	0	0	137
Lane Group Flow (vph)	464	173	0	0	140	41	67	855	0	368	536	159
Turn Type	Split	NA		Split	NA	Prot	Prot	NA		Prot	NA	Perm
Protected Phases	8	8		7	7	7	1	6		5	2	
Permitted Phases												2
Actuated Green, G (s)	19.3	19.3			13.2	13.2	7.0	43.3		27.6	63.9	63.9
Effective Green, g (s)	19.9	19.9			12.2	12.2	7.5	43.8		28.1	64.4	64.4
Actuated g/C Ratio	0.17	0.17			0.10	0.10	0.06	0.36		0.23	0.54	0.54
Clearance Time (s)	4.6	4.6			3.0	3.0	4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0			2.0	2.0	2.0	3.0		2.0	3.0	3.0
Lane Grp Cap (vph)	569	293			188	160	110	1278		414	1899	849
v/s Ratio Prot	c0.14	0.10			c0.08	0.03	0.04	c0.24		c0.21	0.15	
v/s Ratio Perm												0.10
v/c Ratio	0.82	0.59			0.74	0.26	0.61	0.67		0.89	0.28	0.19
Uniform Delay, d1	48.3	46.3			52.4	49.7	54.8	32.0		44.4	15.2	14.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.4	2.1			13.0	0.3	6.4	2.8		19.6	0.4	0.5
Delay (s)	56.6	48.4			65.4	50.0	61.2	34.8		64.0	15.6	14.8
Level of Service	E	D			E	D	E	C		E	B	B
Approach Delay (s)		54.3			54.3			36.7			30.2	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱		✣			✣			✣	
Volume (vph)	14	12	160	84	11	0	584	20	33	0	6	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Frt	1.00	1.00	0.85		1.00			0.99			0.89	
Flt Protected	0.95	1.00	1.00		0.96			0.96			1.00	
Satd. Flow (prot)	1770	1863	1583		1784			1769			1659	
Flt Permitted	0.72	1.00	1.00		0.74			0.72			1.00	
Satd. Flow (perm)	1350	1863	1583		1386			1326			1659	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	16	13	180	94	12	0	656	22	37	0	7	30
RTOR Reduction (vph)	0	0	138	0	0	0	0	2	0	0	10	0
Lane Group Flow (vph)	16	13	42	0	106	0	0	713	0	0	27	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)	18.5	18.5	18.5		18.5			52.5			52.5	
Effective Green, g (s)	18.5	18.5	18.5		18.5			52.5			52.5	
Actuated g/C Ratio	0.23	0.23	0.23		0.23			0.66			0.66	
Clearance Time (s)	4.5	4.5	4.5		4.5			4.5			4.5	
Lane Grp Cap (vph)	312	430	366		320			870			1088	
v/s Ratio Prot		0.01									0.02	
v/s Ratio Perm	0.01		0.03		c0.08			c0.54				
v/c Ratio	0.05	0.03	0.11		0.33			0.82			0.02	
Uniform Delay, d1	23.9	23.8	24.3		25.6			10.2			4.8	
Progression Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2	0.3	0.1	0.6		2.8			8.5			0.0	
Delay (s)	24.2	23.9	24.9		28.4			18.7			4.8	
Level of Service	C	C	C		C			B			A	
Approach Delay (s)		24.8			28.4			18.7			4.8	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	310	49	143	378	240	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	3.0	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.94	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	1863	1744	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	1863	1744	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	333	53	154	406	258	232
RTOR Reduction (vph)	0	39	0	0	17	0
Lane Group Flow (vph)	333	14	154	406	473	0
Turn Type	Prot	Prot	Prot	NA	NA	
Protected Phases	4	4	5	2	6	
Permitted Phases						
Actuated Green, G (s)	21.1	21.1	10.1	48.9	35.8	
Effective Green, g (s)	21.1	21.1	10.1	48.9	35.8	
Actuated g/C Ratio	0.27	0.27	0.13	0.62	0.45	
Clearance Time (s)	5.0	5.0	3.0	4.5	4.5	
Vehicle Extension (s)	3.5	3.5	0.5	3.5	3.5	
Lane Grp Cap (vph)	469	420	224	1145	785	
v/s Ratio Prot	c0.19	0.01	c0.09	0.22	c0.27	
v/s Ratio Perm						
v/c Ratio	0.71	0.03	0.69	0.35	0.60	
Uniform Delay, d1	26.4	21.6	33.2	7.5	16.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.2	0.0	6.8	0.2	1.4	
Delay (s)	31.6	21.7	40.0	7.8	17.9	
Level of Service	C	C	D	A	B	
Approach Delay (s)	30.3			16.6	17.9	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	79.5	Sum of lost time (s)	12.5
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (vph)	306	82	134	551	370	573
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		5.0	3.5	3.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.97		1.00	1.00	0.92	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1741		1770	1863	1710	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1741		1770	1863	1710	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	348	93	152	626	420	651
RTOR Reduction (vph)	13	0	0	0	75	0
Lane Group Flow (vph)	428	0	152	626	996	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	16.0		7.0	51.0	40.0	
Effective Green, g (s)	17.0		6.0	51.5	40.5	
Actuated g/C Ratio	0.23		0.08	0.69	0.54	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.5		0.5	3.5	3.5	
Lane Grp Cap (vph)	394		141	1279	923	
v/s Ratio Prot	c0.25		c0.09	0.34	c0.58	
v/s Ratio Perm						
v/c Ratio	1.09		1.08	0.49	1.08	
Uniform Delay, d1	29.0		34.5	5.5	17.2	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	70.4		98.2	0.4	53.5	
Delay (s)	99.4		132.7	5.9	70.8	
Level of Service	F		F	A	E	
Approach Delay (s)	99.4			30.7	70.8	
Approach LOS	F			C	E	

Intersection Summary			
HCM 2000 Control Delay	62.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	94.8%	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)	11	205	7	209	264	86	8	74	182	66	10	14
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	13	247	8	252	318	104	10	89	219	80	12	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	269	673	318	108
Volume Left (vph)	13	252	10	80
Volume Right (vph)	8	104	219	17
Hadj (s)	0.03	0.02	-0.37	0.09
Departure Headway (s)	6.6	6.0	6.4	7.5
Degree Utilization, x	0.49	1.00	0.57	0.23
Capacity (veh/h)	520	673	537	436
Control Delay (s)	15.7	60.9	17.4	12.7
Approach Delay (s)	15.7	60.9	17.4	12.7
Approach LOS	C	F	C	B

Intersection Summary			
Delay	38.1		
Level of Service	E		
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

APPENDIX E1

Supplemental Traffic Analysis - Loop Road Alternatives

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MEMORANDUM

To: Sean Charpentier

Cc: Maziar Bozorginia, Kamal Fallaha

From: Patrick Siegman and Michael Riebe, PE

Date: April 9, 2016

Subject: EPA General Plan Supplemental Traffic Analysis – Loop Road Alternatives

This memo presents the results of Nelson\Nygaard's supplemental traffic analysis for the East Palo Alto General Plan Update project. It supplements the work presented in the *East Palo Alto General Plan Update Transportation Impact Analysis* (Nelson\Nygaard, February 2016). As you requested, this supplemental analysis forecasts the traffic conditions that could result in 2040 if the proposed General Plan were adopted and the Loop Road shown in the Ravenswood/4 Corners TOD Specific Plan was **not** built.

More specifically, this analysis provides the following information:

1. **For the University Avenue and Bay Road intersection**: an assessment of the automobile level of service (LOS) for this intersection under two scenarios:
   a. Under Cumulative with Project Conditions, with the completion of the Loop Road shown in the Ravenswood/4 Corners TOD Specific Plan.
   b. Under Cumulative with Project Conditions, *without the Loop Road*.
2. **For the University Avenue and Loop Road intersection**: the level of service (LOS) for this future intersection under Cumulative with Project Conditions, if the Loop Road is built.

The Cumulative with Project Conditions scenario is fully defined in the *East Palo Alto General Plan Update Transportation Impact Analysis*. In brief, this scenario estimates what traffic conditions will be like in 2040 given projected traffic volumes and the projected roadway system. The projected traffic volumes in this scenario include traffic due to buildout of land uses consistent with the proposed General Plan and the approved Ravenswood/4 Corners TOD Specific Plan, and traffic increases due to regional growth. Planned roadway system changes specified in the Ravenswood/4 Corners TOD Specific Plan are assumed.

ANALYSIS RESULTS

The results of the analysis are presented in Table 1. They show how the presence or absence of the Loop Road directly affects traffic operations at the University/Bay intersection. In the With Loop Road alternative, the intersection operates at LOS D in the AM peak period and LOS E in the PM peak period. In the Without Loop Road alternative, the LOS at University/Bay degrades to LOS E in the AM and LOS F in the PM peak periods. This is because most vehicles in the new Ravenswood/4 Corners development would be required to access University Avenue through Bay

Road, with no good alternative available. The effects on this intersection of building the Loop Road can be estimated by comparing delays in the With and Without Loop Road alternatives. At the University/Bay intersection, the Loop Road alleviates 17 seconds of average delay in the AM peak period and 46 seconds of average delay in the PM peak period.

In the With Loop Road alternative, the University Avenue/Loop Road intersection operates at LOS C in the AM and LOS E in the PM peak. (In the Without Loop Road alternative, of course, this intersection does not exist.)

Table 1 Comparison of Intersection LOS with and without Loop Road

Intersection	Peak Hour	With Loop Road		Without Loop Road	
		Delay (sec)	LOS	Delay (sec)	LOS
University Ave/Bay Rd	AM	46	D	**63**	**E**
	PM	**63**	**E**	**109**	**F**
University Ave/Loop Rd	AM	21	C	N/A	
	PM	**63**	**E**		

The remainder of this memo provides additional background information and briefly describes the methodology used for the analysis. Additional information on the traffic analysis methodology and related topics may be found in the *East Palo Alto General Plan Update Transportation Impact Analysis*. Copies of the Synchro Analysis LOS calculation sheets are attached at the end of this memorandum.

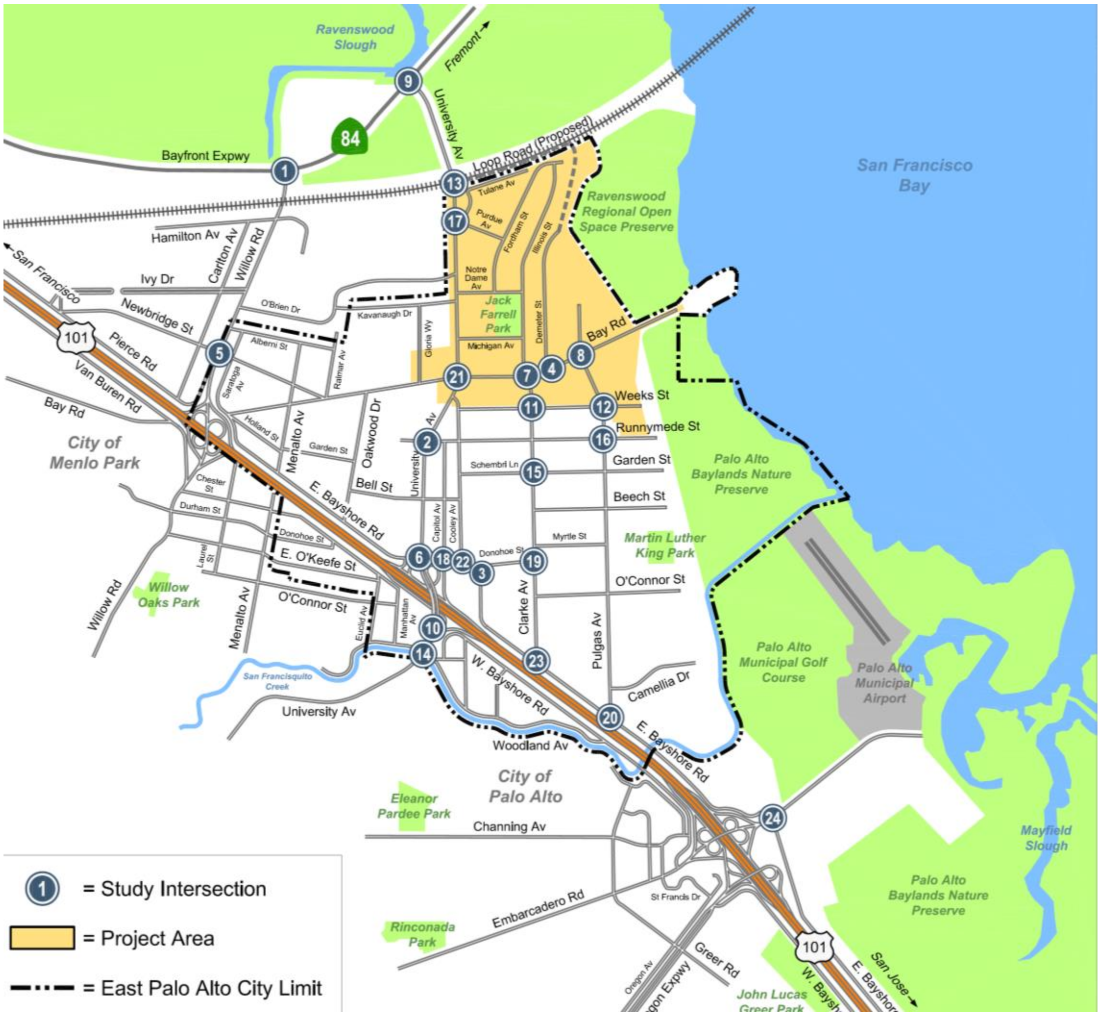
BACKGROUND

For the *East Palo Alto General Plan Update Transportation Impact Analysis*, Nelson\Nygaard analyzed the LOS at 10 intersections within and adjacent to East Palo Alto. One of the intersections included in this analysis was University Avenue and Bay Road. The traffic analysis, in both the Cumulative without Project Conditions and Cumulative with Project Conditions scenarios, assumed that all roadway changes included in the approved *Ravenswood/4 Corners TOD Specific Plan* (and specified as mitigations for the Plan's traffic impacts) would be built. This includes the Loop Road.

The alignment of the Loop Road is shown in Figure 1. The following text from the *Ravenswood/4 Corners TOD Specific Plan* describes the route and purpose of the Loop Road:

> *The new roadway would extend northward from the current termination point of Demeter Street. Just south of the Dumbarton Rail Line, the new roadway would turn to the west and connect with University Avenue near the East Palo Alto city limits. The new Loop Road is intended to provide a direct route between the Plan Area and University Avenue that avoids the constraints posed by the University/Bay intersection. In addition to serving project trips, the new Loop Road may be used by some existing traffic that chooses to divert from University Avenue.*

Figure 1 Roadway Network showing Loop Road in Ravenswood/4 Corners TOD Specific Plan EIR



ANALYSIS METHODOLOGY

This section briefly describes the methodology used for the supplemental traffic analysis.

The consultant team's regional travel demand modeler, Damian Stefanakis of Kittelson and Associates, reran the San Mateo City/County Association of Governments Travel Demand Model to provide traffic volumes at the Loop Road intersection with University Avenue for the Cumulative with Project Conditions scenario. The intersection turning movement volumes at the Loop Road/University Avenue intersection were extracted. Table 1 shows the intersection volumes obtained from the model.

Intersection turning movement volumes and LOS results for University Avenue/Bay Road in the "With Loop Road" alternative were obtained from the *East Palo Alto General Plan Update Transportation Impact Analysis*. To determine the predicted traffic volumes at this intersection in the "Without Loop Road" alternative, Kittelson and Associates manually reassigned vehicle trips from the Loop Road to the intersection of University/Bay. Table 1 shows the predicted traffic volumes for the intersection, with and without the Loop Road.

Synchro Version 9 traffic analysis software was used to calculate level of service for the study intersections. The turning movement volumes shown in Table 1 were used as inputs into the Synchro traffic analysis. Assumptions made in the Synchro model analysis of the new University Avenue/Loop Road intersection were:

- Number of approach lanes and turning pockets are identical to the configuration shown in the *Ravenswood/4 Corners TOD Specific Plan*
- Signal cycle lengths were matched to be the same or similar to adjacent intersections on University Avenue to enhance coordination opportunities
- Signals were optimized to minimize delay in both the AM and PM peak periods

Table 1 Cumulative with Project Conditions Traffic Volumes with and without the Loop Road

Scenario	Intersection		Peak Hour	Northbound			Southbound			Eastbound			Westbound		
	N/S Street	E/W Street		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
With Loop Road	University	Loop Rd	AM	0	1353	179	348	1678	0	0	0	0	86	0	80
			PM	0	1629	115	55	1188	0	0	0	0	294	0	475
	University	Bay Rd	AM	114	742	89	126	1045	73	49	193	73	78	378	166
			PM	58	1090	115	442	739	68	143	277	110	215	268	412
Without Loop Road	University	Bay Rd	AM	114	742	177	250	1045	73	49	384	73	112	403	237
			PM	58	1090	130	499	739	68	143	313	110	395	288	756

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↰	↱	↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	49	384	73	112	403	237	114	742	177	250	1045	73
Future Volume (vph)	49	384	73	112	403	237	114	742	177	250	1045	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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	51	396	75	115	415	244	118	765	182	258	1077	75
RTOR Reduction (vph)	0	0	59	0	0	174	0	0	112	0	4	0
Lane Group Flow (vph)	51	396	16	102	428	70	118	765	70	258	1148	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	27.1	27.1	27.1	33.0	33.0	33.0	10.2	34.2	34.2	20.2	44.7	
Effective Green, g (s)	27.1	27.1	27.1	33.0	33.0	33.0	9.7	34.2	34.2	19.7	44.2	
Actuated g/C Ratio	0.21	0.21	0.21	0.25	0.25	0.25	0.07	0.26	0.26	0.15	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	368	388	329	817	429	401	132	931	416	268	1191	
v/s Ratio Prot	0.03	c0.21	0.01	0.03	c0.25	0.04	0.07	0.22		c0.15	c0.33	
v/s Ratio Perm									0.04			
v/c Ratio	0.14	1.02	0.05	0.12	1.00	0.17	0.89	0.82	0.17	0.96	0.96	
Uniform Delay, d1	41.9	51.5	41.1	37.4	48.5	37.9	59.6	45.0	36.9	54.8	42.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.12	0.70	0.45	1.00	1.00	
Incremental Delay, d2	0.1	51.0	0.0	0.0	42.5	0.1	40.5	6.7	0.7	44.2	18.7	
Delay (s)	42.0	102.5	41.2	37.4	90.9	37.9	107.4	38.1	17.2	99.0	60.9	
Level of Service	D	F	D	D	F	D	F	D	B	F	E	
Approach Delay (s)		87.8			67.2			42.2			67.8	
Approach LOS		F			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	63.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.2%	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	↰	↑	↱	↰↰	↰	↱	↰	↑↑	↱	↰	↑↱	
Traffic Volume (vph)	143	313	110	395	288	756	58	1090	130	499	739	68
Future Volume (vph)	143	313	110	395	288	756	58	1090	130	499	739	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1684	1583	1770	3539	1583	1770	3495	
Flt Permitted	0.95	1.00	1.00	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1684	1583	1770	3539	1583	1770	3495	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	147	323	113	407	297	779	60	1124	134	514	762	70
RTOR Reduction (vph)	0	0	96	0	0	352	0	0	72	0	5	0
Lane Group Flow (vph)	147	323	17	362	342	427	60	1124	62	514	827	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	19.0	19.0	19.0	26.0	26.0	26.0	7.1	37.0	37.0	32.5	62.9	
Effective Green, g (s)	19.0	19.0	19.0	26.0	26.0	26.0	6.6	37.0	37.0	32.0	62.4	
Actuated g/C Ratio	0.15	0.15	0.15	0.20	0.20	0.20	0.05	0.28	0.28	0.25	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	258	272	231	644	336	316	89	1007	450	435	1677	
v/s Ratio Prot	0.08	c0.17	0.01	0.11	0.20	c0.27	0.03	c0.32		c0.29	0.24	
v/s Ratio Perm									0.04			
v/c Ratio	0.57	1.19	0.07	0.56	1.02	1.35	0.67	1.12	0.14	1.18	0.49	
Uniform Delay, d1	51.7	55.5	47.9	46.9	52.0	52.0	60.6	46.5	34.6	49.0	23.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.01	0.73	0.47	1.00	1.00	
Incremental Delay, d2	1.7	115.1	0.0	0.7	53.7	177.6	11.9	63.5	0.5	103.1	1.0	
Delay (s)	53.4	170.6	47.9	47.5	105.7	229.6	73.2	97.4	16.9	152.1	24.1	
Level of Service	D	F	D	D	F	F	E	F	B	F	C	
Approach Delay (s)		117.3			156.6			88.2			72.9	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	108.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.4%	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)	49	193	73	78	378	166	114	742	89	126	1045	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	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1693	1583	1770	3539	1583	1770	3505	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	51	199	75	80	390	171	118	765	92	130	1077	75
RTOR Reduction (vph)	0	0	65	0	0	127	0	0	55	0	4	0
Lane Group Flow (vph)	51	199	10	71	399	44	118	765	37	130	1148	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	16.5	16.5	16.5	33.2	33.2	33.2	11.4	51.6	51.6	13.2	53.9	
Effective Green, g (s)	16.5	16.5	16.5	33.2	33.2	33.2	10.9	51.6	51.6	12.7	53.4	
Actuated g/C Ratio	0.13	0.13	0.13	0.26	0.26	0.26	0.08	0.40	0.40	0.10	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	224	236	200	822	432	404	148	1404	628	172	1439	
v/s Ratio Prot	0.03	c0.11	0.01	0.02	c0.24	0.03	0.07	0.22		c0.07	c0.33	
v/s Ratio Perm									0.02			
v/c Ratio	0.23	0.84	0.05	0.09	0.92	0.11	0.80	0.54	0.06	0.76	0.80	
Uniform Delay, d1	51.0	55.5	49.8	36.9	47.2	37.1	58.5	30.2	24.2	57.1	33.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.32	0.88	0.65	1.00	1.00	
Incremental Delay, d2	0.2	22.2	0.0	0.0	25.0	0.0	19.8	1.2	0.1	15.3	4.7	
Delay (s)	51.2	77.7	49.9	36.9	72.1	37.1	97.1	27.7	15.8	72.5	38.3	
Level of Service	D	E	D	D	E	D	F	C	B	E	D	
Approach Delay (s)		67.1			58.9			35.0			41.7	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	45.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
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)	143	277	110	215	268	412	58	1090	115	442	739	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3495	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1863	1583	3221	1688	1583	1770	3539	1583	1770	3495	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	147	286	113	222	276	425	60	1124	119	456	762	70
RTOR Reduction (vph)	0	0	96	0	0	350	0	0	68	0	5	0
Lane Group Flow (vph)	147	286	17	198	300	75	60	1124	51	456	827	0
Turn Type	Split	NA	Prot	Split	NA	Prot	Prot	NA	Perm	Prot	NA	
Protected Phases	3	3	3	4	4	4	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	19.0	19.0	19.0	21.0	21.0	21.0	7.1	42.0	42.0	32.5	67.9	
Effective Green, g (s)	19.0	19.0	19.0	21.0	21.0	21.0	6.6	42.0	42.0	32.0	67.4	
Actuated g/C Ratio	0.15	0.15	0.15	0.16	0.16	0.16	0.05	0.32	0.32	0.25	0.52	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.5	4.0	4.0	3.5	3.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.5	4.0	4.0	1.5	2.5	
Lane Grp Cap (vph)	258	272	231	520	272	255	89	1143	511	435	1812	
v/s Ratio Prot	0.08	c0.15	0.01	0.06	c0.18	0.05	0.03	c0.32		c0.26	0.24	
v/s Ratio Perm									0.03			
v/c Ratio	0.57	1.05	0.07	0.38	1.10	0.29	0.67	0.98	0.10	1.05	0.46	
Uniform Delay, d1	51.7	55.5	47.9	48.7	54.5	48.0	60.6	43.7	30.8	49.0	19.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.27	0.84	0.71	1.00	1.00	
Incremental Delay, d2	1.7	68.7	0.0	0.2	85.0	0.2	11.9	20.1	0.3	56.4	0.8	
Delay (s)	53.4	124.2	47.9	48.9	139.5	48.2	88.7	56.7	22.2	105.4	20.6	
Level of Service	D	F	D	D	F	D	F	E	C	F	C	
Approach Delay (s)		89.4			78.0			55.0			50.6	
Approach LOS		F			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	63.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	86	80	1353	179	348	1678
Future Volume (vph)	86	80	1353	179	348	1678
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.93		0.98		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1697		3477		1770	3539
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1697		3477		1770	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	87	1471	195	378	1824
RTOR Reduction (vph)	26	0	7	0	0	0
Lane Group Flow (vph)	154	0	1659	0	378	1824
Turn Type	Prot		NA		Prot	NA
Protected Phases	8		2		1	6
Permitted Phases						
Actuated Green, G (s)	15.5		70.3		30.7	105.5
Effective Green, g (s)	15.5		70.3		30.7	105.5
Actuated g/C Ratio	0.12		0.54		0.24	0.81
Clearance Time (s)	4.5		4.5		4.5	4.5
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	202		1880		417	2872
v/s Ratio Prot	c0.09		c0.48		c0.21	0.52
v/s Ratio Perm						
v/c Ratio	0.76		0.88		0.91	0.64
Uniform Delay, d1	55.5		26.2		48.3	4.8
Progression Factor	1.00		0.54		1.00	1.00
Incremental Delay, d2	15.4		6.2		22.8	1.1
Delay (s)	70.9		20.4		71.1	5.8
Level of Service	E		C		E	A
Approach Delay (s)	70.9		20.4			17.0
Approach LOS	E		C			B

Intersection Summary			
HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	294	475	1629	115	55	1188
Future Volume (vph)	294	475	1629	115	55	1188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.95		1.00	0.95
Frt	0.92		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1675		3504		1770	3539
Flt Permitted	0.98		1.00		0.06	1.00
Satd. Flow (perm)	1675		3504		116	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	320	516	1771	125	60	1291
RTOR Reduction (vph)	5	0	4	0	0	0
Lane Group Flow (vph)	831	0	1892	0	60	1291
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	56.5		64.5		64.5	64.5
Effective Green, g (s)	56.5		64.5		64.5	64.5
Actuated g/C Ratio	0.43		0.50		0.50	0.50
Clearance Time (s)	4.5		4.5		4.5	4.5
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	727		1738		57	1755
v/s Ratio Prot	c0.50		c0.54			0.36
v/s Ratio Perm					0.52	
v/c Ratio	1.14		1.09		1.05	0.74
Uniform Delay, d1	36.8		32.8		32.8	26.0
Progression Factor	1.00		0.39		1.00	1.00
Incremental Delay, d2	80.5		46.4		134.7	2.8
Delay (s)	117.2		59.2		167.5	28.8
Level of Service	F		E		F	C
Approach Delay (s)	117.2		59.2			34.9
Approach LOS	F		E			C

Intersection Summary			
HCM 2000 Control Delay	63.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	101.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX F

Water Supply Assessment

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Water Supply Assessment

City of East Palo Alto

General Plan Update

Performed for:

City of East Palo Alto

Project location:

East Palo Alto, California

Prepared by:

Integrated Resource Management, Inc.

405 North Indian Hill Boulevard
Claremont, California 91711-4614

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(909) 621-1266

December 29, 2015

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of Abbreviations

AF	Acre-Foot or -Feet (i.e., 1 acre x 1 foot deep)
AFY	Acre-Feet per Year
BAWSCA	Bay Area Water Supply and Conservation Agency
CEQA	California Environmental Quality Act
DWR	California Department of Water Resources
EPA	City of East Palo Alto
EPASD	East Palo Alto Sanitary District
ET	Evapotranspiration
°F	Degrees Fahrenheit
GPCD	Gallons Per Capita Per Day
gpm	Gallons Per Minute
ISA	Interim Supply Allocation
ISG	Individual Supply Guarantee
ISL	Interim Supply Limitation
mgd	Million Gallons Per Day
mg/L	Milligrams Per Liter
O'Connor Tract	O'Connor Tract Co Op Water Company
PAPMWC	Palo Alto Park Mutual water Company
PEIR	Program Environmental Impact Report
psi	Pounds Per Square Inch
RWQCP	Regional Water Quality Control Plant
RWS	San Francisco Regional Water System
SB	Senate Bill
SBSA	South Bayside System Authority
SBSARTP	Regional Treatment Plant
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SFPUC Agreement	Water Supply Agreement, July 2009
SMCL	Secondary Maximum Contaminate Level
WBSD	West Bay Sanitary District
WSA	Water Supply Assessment
WSAP	Water Shortage Allocation Plan
WSIP	Water System Improvement Program

1.0 INTRODUCTION

This Water Supply Assessment (WSA) has been prepared to assist the City of East Palo Alto Planning Department in satisfying the requirements of Senate Bill 610 (SB 610) for the City of East Palo Alto General Plan Update (Proposed Project). The stated intent of SB 610 is to strengthen the process by which local agencies determine the adequacy, sufficiency, and quality of current and future water supplies in order to meet current and future demands.

A General Plan outlines proposed growth and development throughout a city. The existing City of East Palo Alto General Plan was adopted in 1999 and guides decision making for land use and City services. Since the adoption of the 1999 General Plan, there have been significant changes, including substantial shifts in job and housing markets, demographics, and transportation and infrastructure needs. Therefore, the City of East Palo Alto is preparing a comprehensive update to its 1999 General Plan and its Zoning Code which, together, will serve as a blueprint to guide the City's vision for its long-term land use and development through the year 2035.

The City of East Palo Alto, Community and Economic Development Department, Planning Division is the lead agency for the Proposed Project. The City of East Palo Alto is providing this WSA pursuant to SB 610 for the purpose of ensuring there are sufficient water supplies available for the Proposed Project.

Water Code Part 2.10 defines the "Projects" that are subject to a WSA and the Lead Agency's responsibilities related to the WSA. A WSA is required for:

(1) A proposed residential development of more than 500 dwelling units.

(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.

(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.

(4) A proposed hotel or motel, or both, having more than 500 rooms.

(5) A proposed industrial, manufacturing, or processing plant or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.

(6) A mixed-use development that includes one or more of the uses described above.

(7) A development that would demand an amount of water equivalent to or greater than the amount of water required by a 500-dwelling-unit project.

(8) For Lead Agencies with under 5,000 water service connections, any new development that will increase the number of water service connections in the service area by ten percent or more.

SB 610 amended Water Code sections 10910 and 10912 to create a direct relationship between water supply and land use. In general terms, SB 610 requires the identification of an adequate 20-year water supply prior to constructing developments with more than 500 homes or the equivalent.

SB 610 was enacted in 2001 to improve the connection between water supplies and land use planning. It was intended to ensure greater communication between water providers and local planning agencies. Accordingly, SB 610 aims to ensure that land use decisions for certain large development projects are fully informed as to whether sufficient water supplies are available to serve the projects.

Further, under SB 610, water supply assessments must be furnished to local governments for inclusion in the environmental documentation for certain projects (as defined in Water Code Section 10912 [a]) that are subject to the California Environmental Quality Act (CEQA).

A WSA is, at its heart, an informational document that the CEQA lead agency relies on in deciding whether to approve projects. In this way, a WSA is similar to other informational documents used to support the analysis of impacts in an Environmental Impact Report (EIR), such as biological resource studies.

This WSA:

1. Provides information on the Proposed Project's water supply consistent with Water Code section 10620 *et seq.* (the Urban Water Management Act) and section 10910 *et seq.* (Water Supply Planning to Support Existing and Planned Future Uses).

2. Provides data necessary to produce the sufficiency findings required by CEQA.

1.1 Project Background

The City of East Palo Alto is located in the southern corner of San Mateo County and borders Santa Clara County. The City, including areas both to the west and east of Highway 101, is bound on the north by the City of Menlo Park, on the west by the City of Palo Alto, on the east by the San Francisco Bay, and on the south by sloughs leading to San Francisquito Creek and the Bay. The water system covers a 2.5-square-mile area.

For most of its history, East Palo Alto was part of unincorporated San Mateo County and it did not have an official boundary until it incorporated in 1983. As a result, distinct districts have grown to have their own identity, including many of those mentioned above as well as University Village, Palo Alto Gardens, Woodland Place, Palo Alto Park and Bayshore Park.

The General Plan Update is projecting a population increase of 26% in the next 25 years.

The City's water is provided by three water companies; City of East Palo Alto/American Water Enterprise, Palo Alto Park Mutual Water Company (PAPMWC), and O'Connor Tract Co Op Water Company (O'Connor Tract).

Figure 1-1 General Plan Planning Area

Source: 2000/2010 U.S. Census, San Mateo County GIS Enterprise Database and Santa Clara County, 2012.

1.2 Weather Data

The San Francisco Bay region has a Mediterranean climate characterized by dry, warm summers and mild winters. The area receives most of its rainfall between November and April and its warmest temperatures in May through September. The average annual rainfall for the City of East Palo Alto is approximately 15 inches. Daily summer temperatures vary from 48°F to 78°F while winter temperatures rarely descend below freezing.

Table 1-1 gives data on the climate of the region as it impinges on its water supplies, including average rainfall, average temperature, and average rate of evapotranspiration (ET—i.e., the rate that water either evaporates or is expired by vegetation into the atmosphere).

Table 1-1 Climate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Rainfall (inches)	3.15	2.89	2.29	1.02	0.37	0.09	0.02	0.05	0.17	0.73	1.73	2.70	**15.21**
Average Temperature (°F)	47.9	51.2	53.7	56.5	60.7	65.0	66.7	66.5	65.5	60.5	53.5	47.9	**58.00**
Average ETo (inches per month)	1.43	1.89	3.37	4.42	5.54	6.01	6.20	5.53	4.35	3.05	1.69	1.31	**44.79**

Sources: Monthly Average ETo Report (No. 171, Union City, San Francisco Bay Region), CIMIS, Department of Water Resources, Office of Water Use Efficiency, Accessed November 15, 2015; Western Regional Climate Center. Palo Alto, California (Station 046646) http://www.wrcc.dri.edu, Accessed November 15, 2015

1.3 Population Projections

Past and projected populations within the City are shown in the following table.

Table 1-2 Past and Projected Population

	2010[1]	2015	2020	2025	2030	2035	2040
Population	**28,155**	**30,501**	**31,767**	**33,122**	**34,570**	**36,120**	**37,781**

[1] *2010 population from 2010 Census.*

Due to the City being served by three water providers, two of which serve water outside of the city limits, the population projections were then broken down into zones within the city to better understand the growth projections within each water system. Using the 2010 Census data blocks, population projections were made for each of the water systems.

Table 1-3 Population Zones

Zones	2010	2015	2020	2025	2030	2035	2040
1579	**2,306**	**2,354**	**2,490**	**2,634**	**2,787**	**2,948**	**3,118**
1580	**4,018**	**4,351**	**4,376**	**4,401**	**4,426**	**4,451**	**4,476**
American Water	*2,159*	*2,349*	*2,363*	*2,376*	*2,390*	*2,404*	*2,417*
PAPMWC	*1,859*	*2,001*	*2,013*	*2,024*	*2,036*	*2,047*	*2,059*
1631	**1,410**	**1,704**	**1,715**	**1,727**	**1,738**	**1,750**	**1,762**
1632	**2,955**	**3,087**	**3,091**	**3,095**	**3,099**	**3,104**	**3,108**
1682	**3,674**	**3,813**	**4,087**	**4,380**	**4,694**	**5,031**	**5,392**
2032	**3,018**	**3,108**	**3,366**	**3,646**	**3,949**	**4,277**	**4,633**
2033	**1,390**	**1,406**	**1,406**	**1,406**	**1,406**	**1,406**	**1,406**
2034	**3,309**	**3,412**	**3,535**	**3,664**	**3,798**	**3,939**	**4,086**
American Water	*2,146*	*2,229*	*2,339*	*2,455*	*2,576*	*2,703*	*2,836*
PAPMWC	*1,163*	*1,183*	*1,196*	*1,209*	*1,222*	*1,236*	*1,250*
2035	**6,075**	**7,266**	**7,702**	**8,169**	**8,673**	**9,214**	**9,801**
American Water	*3,889*	*4,691*	*5,078*	*5,496*	*5,949*	*6,440*	*6,974*
PAPMWC	*206*	*215*	*220*	*225*	*230*	*235*	*240*
O'Connor	*1,980*	*2,361*	*2,404*	*2,448*	*2,493*	*2,539*	*2,586*
Totals	**28,155**	**30,501**	**31,767**	**33,122**	**34,570**	**36,120**	**37,781**
American Water	22,947	24,741	25,935	27,215	28,589	30,062	31,646
PAPMWC	3,228	3,399	3,428	3,458	3,488	3,518	3,549
O'Connor	1,980	2,361	2,404	2,448	2,493	2,539	2,586

[1] *2010 population from 2010 Census.*

1.4 City of East Palo Alto/American Water Enterprise

The City of East Palo Alto's public water system is run through the City's Department of Public Works under contract by American Water Enterprises. A major portion of the city's water system was formerly operated by the County of San Mateo under the name East Palo Alto County Waterworks District. The City of East Palo Alto assumed operation of the water distribution system from San Mateo County in 2001. Currently, American Water Enterprise manages the distribution, operation, and maintenance of the municipal water system on behalf of, and under contract with, the City of East Palo Alto.

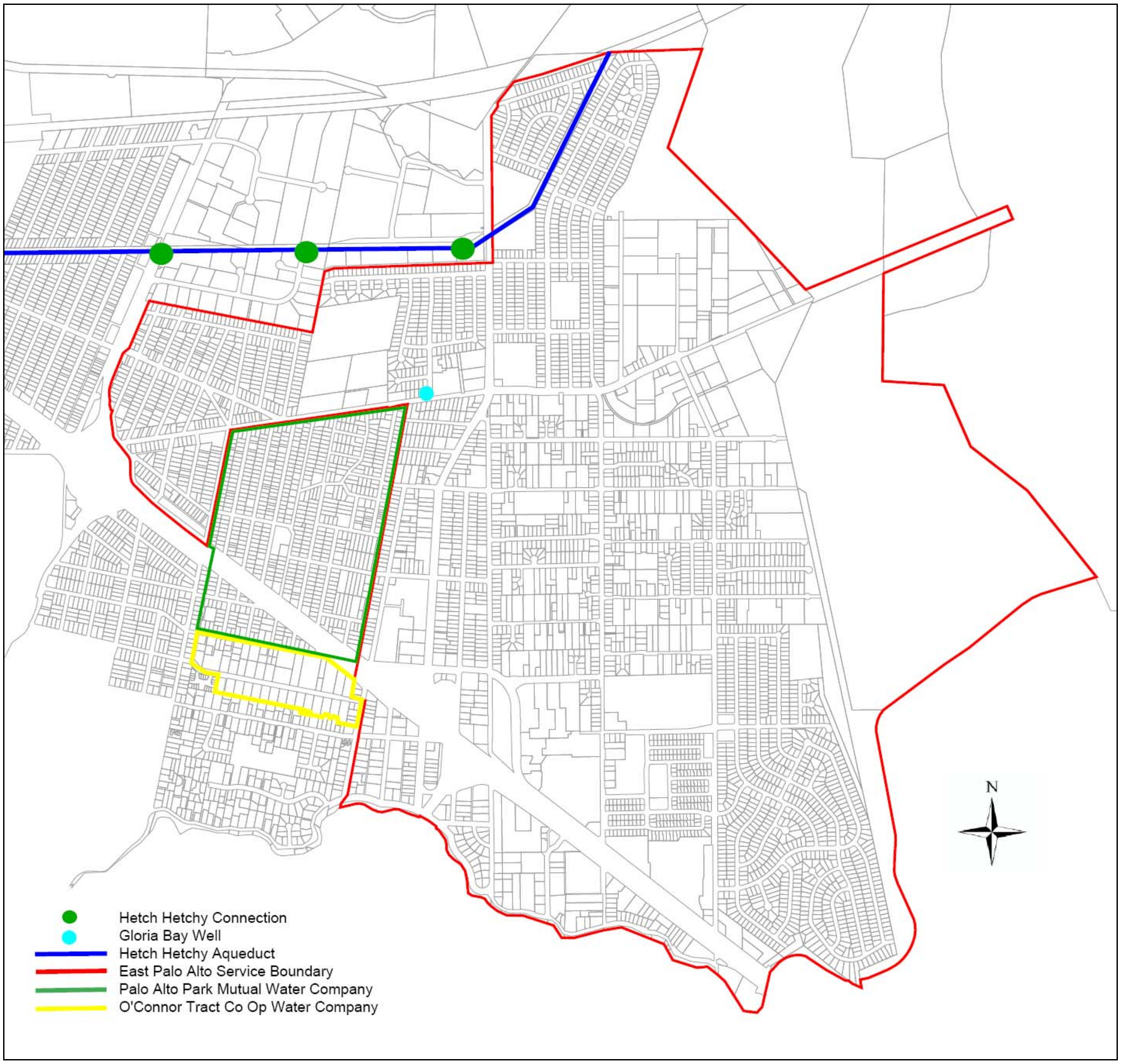
1.5 Palo Alto Park Mutual Water Company

Palo Alto Park Mutual Water Company is a non-profit mutual benefit corporation; a mutual water company incorporated in the state of California and owned by approximately 650 property owners in the Palo Alto Park area, a subdivision in East Palo Alto, and Menlo Park. Its area of service covers homes between Bay Road, Glen Way, Menalto (across the Bayshore Freeway), Donohue, and Menalto. The company is not a public utility and can only sell water to the shareholders within the service area. Palo Alto Park Mutual Water Company is a ground water system. The water is served by five (5) wells, ranging from one hundred twenty-five to eight hundred gallons per minute and stored in two storage tanks with the capacities of 11,500 and 350,000 gallons.

1.6 O'Connor Tract Co Op Water Company

O'Connor Tract Co-operative Water Company is a non-profit organization founded on January 31, 1921 to supply water to a small portion of East Palo Alto and Menlo Park. The Company serves approximately 343 connections. Its service area is bounded by Donohoe Street on the north, Woodland Avenue on the south, Menalto Avenue on the west, and Euclid Avenue on the east. The water is supplied from two deep wells and then pumped into a 100,000-gallon tank before being distributed to the system.

Figure 1-2 City of East Palo Alto Water Systems – Map



Note: Water system boundaries are only shown for sections within the City.

2.0 WATER SOURCES

Three water companies supply water to the City of East Palo Alto; City of East Palo Alto/American Water Enterprise, Palo Alto Park Mutual Water Company, and O'Connor Tract Co-Op Water Company. The City of East Palo Alto managed water system receives all of its domestic water from the SFPUC with limited groundwater produced for non-potable uses such as street sweeping and construction. PAPMWC and O'Connor Tract rely primarily on groundwater with backup connections to the City of East Palo Alto water system.

2.1 San Francisco Public Utilities Company

The City of East Palo Alto receives water from the City and County of San Francisco's Regional Water System (RWS), operated by the SFPUC. This supply is predominantly from the Sierra Nevada, delivered through the Hetch Hetchy aqueducts, but also includes treated water produced by the SFPUC from its local watersheds and facilities in Alameda and San Mateo Counties.

Through the RWS, SFPUC supplies to both retail and wholesale customers. Its retail customers include the residents, businesses and industries located within the City and County of San Francisco. SFPUC also provides retail water service to other customers located outside of San Francisco, including Treasure Island, the Town of Sunol, San Francisco International Airport, and Lawrence Livermore Laboratory. The SFPUC also sells water on a wholesale basis to 26 water agencies in San Mateo, Santa Clara, and Alameda Counties of which East Palo Alto is one.

The amount of imported water available to the SFPUC's retail and wholesale customers is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC is very dependent on reservoir storage to firm-up its water supplies.

The SFPUC serves its retail and wholesale water demands with an integrated operation of local Bay Area water production and imported water from Hetch Hetchy. In practice, the local watershed facilities are operated to capture local runoff.

2.1.1 2009 Water Supply Agreement

The business relationship between San Francisco and its wholesale customers is largely defined by the "Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County" entered into in July 2009 (SFPUC Agreement). The new SFPUC Agreement replaced the Settlement Agreement and Master Water Sales Contract that expired June 2009. The SFPUC Agreement addresses the rate-making methodology used by the City in setting wholesale water rates for its wholesale customers in addition to addressing water supply and water shortages for the RWS. The SFPUC Agreement has a 25 year term, with provisions for two five-year extensions.

In terms of water supply, the SFPUC Agreement provides for an Interim Supply Limitation (ISL) of 184 million gallons per day (mgd), expressed on an annual average basis, at least through the year 2018. A surcharge will be imposed to enforce the interim supply limitation. By December 31, 2018, San Francisco will make further decisions regarding long-term water supplies through 2030. The SFPUC Agreement does not guarantee that San Francisco will meet peak daily or hourly customer demands when their annual usage exceeds the Supply Assurance. The SFPUC's wholesale customers have agreed to the allocation of the 184 mgd Supply Assurance among themselves, with each entity's share of the Supply Assurance set forth on Attachment C to the SFPUC Agreement. The Supply Assurance survives termination or expiration of the SFPUC Agreement and this agency's Individual Water Sales Contract with San Francisco.

In their individual water sales contracts with SFPUC, the cities of San José and Santa Clara retain their temporary interruptible status. San Francisco will supply a combined annual average of 9 mgd to the two cities through 2018, subject to interruption or reduction if wholesale customer use exceeds the 184 mgd limit.

Furthermore, the individual supply guarantees of the 26 wholesale customers (other than Hayward, San José and Santa Clara) are subject to reduction on a pro-rata basis if total delivery to City of Hayward and to the wholesale customers exceeds 184 MGD over a consecutive three-year period.

The Water Shortage Allocation Plan between the SFPUC and its wholesale customers, adopted as part of the SFPUC Agreement in July 2009, addresses shortages of up to 20% of system-wide use. The Tier 1 Shortage Plan allocates water from the RWS between San Francisco Retail and the wholesale customers during system-wide shortages of 20% or less. The SFPUC Agreement also anticipated a Tier 2 Shortage Plan adopted by the wholesale customers which would allocate the available water from the RWS among the wholesale customers.

2.1.2 City of East Palo Alto Individual Supply Guarantees

In 2009, the City of East Palo Alto, along with 25 other Bay Area water suppliers signed the SFPUC Agreement with San Francisco, supplemented by an individual Water Supply Contract. These contracts, which expire in 25 years, provide for a 184 mgd (mgd, expressed on an annual average basis) Supply Assurance to the SFPUC's wholesale customers collectively. East Palo Alto's Individual Supply Guarantee (ISG) is 1.963 MGD (or approximately 2,199 acre feet per year). Although the SFPUC Agreement and accompanying Water Supply Contract expire in 2034, the Supply Assurance (which quantifies San Francisco's obligation to supply water to its individual wholesale customers) survives their expiration and continues indefinitely.

2.2 Local Groundwater

2.2.1 Background

East Palo Alto is located over the Santa Clara Valley Groundwater Basin, San Mateo Subbasin, and the San Francisquito Watershed. This San Mateo Subbasin is not adjudicated and has not been identified or projected to be in overdraft by the California Department of Water Resources. Several groundwater management plans have been developed for the San Mateo Subbasin.

2.2.2 Santa Clara Valley Groundwater Basin

The Santa Clara Basin is located in the San Francisco Hydrological Unit as defined by the Department of Water Resources. The basin is further divided into four subbasins: Niles Cone, Santa Clara, San Mateo Plain, and East Bay Plain. The basin is defined as encompassing 345,300 square miles of the San Francisco Hydrological Unit. The basin straddles the southern portion of the San Francisco Bay and is bounded on the east side of the bay by the northwest trending Coast Range, on the west side of the bay by north by San Pablo Bay, and to the south by the groundwater divide near the town of Morgan Hill. The Diablo Range bounds it on the west and the Santa Cruz Mountains form the basin boundary on the east.

2.2.3 Santa Clara Valley Groundwater Basin, San Mateo Subbasin

The Santa Clara Valley Groundwater Basin, San Mateo Subbasin covers approximately 75 square miles on the west side of the San Francisco Bay. The San Mateo Subbasin occupies a geological trough running underground and parallel to the northwest-trending Coast Ranges at the southwest end of San Francisco Bay. The subbasin is bound by the Santa Cruz Mountains in the west, the Westside Basin to the north and San Francisquito Creek to the south. The basin is composed of alluvial fan deposits formed by tributaries to San Francisco Bay that drain the basin.

The water bearing formations of the San Mateo subbasin are comprised of two groups: the Santa Clara Formation and the Quaternary Alluvium (i.e., sediments deposited by streams). The Quaternary Alluvium is the most important water bearing formation of this basin; all larger yielding wells, including the Gloria Bay Well, acquire their water from it.

- **The Santa Clara Formation –** The Santa Clara Formation was formed during the Plio-Pleistocene Age and underlies the Quaternary Alluvium at depths greater than 200 feet. It is composed of gravel, sand, silt, and clay. Permeability—the ability for water to travel through and collect in the ground—tends to increase from west to east but decrease with depth, implying that the formation became coarser grained and more permeable with time.

- **The Quaternary Alluvium –** The Quaternary Alluvium lies on top of the Santa Clara Formation at a maximum depth of 1,250 feet and is composed of gravel, sand, silt, and clay. The alluvium is coarse grained and is generally unconfined (i.e., open to direct percolation of surface water). A permeable alluvium deposited by the many streams that converge and flow eastward out of the basin underlies the central portion of the valley. A relatively shallow water table aquifer overlies confined and semi-confined aquifers in this lowland area. Most of the wells in the basin draw water from the deeper confined and semi-confined aquifers.

Natural recharge occurs by infiltration of water from streams that enter the valley from the upland areas within the drainage basin and by percolation of precipitation that falls directly onto the valley floor. It is estimated that the San Francisquito Creek adds about 1,000 acre-feet of recharge to the groundwater subbasin immediately underneath East Palo Alto annually. Infiltration of runoff from the foothills, over-irrigation, urban watering, and leakage from water distribution and storm water systems also contribute to groundwater recharge.

Historically, groundwater resources in the area were developed to meet irrigation needs. Heavy groundwater pumping from the early 1920s to the mid-1960s caused movement of saline water from San Francisco Bay inland and land subsidence in parts of Palo Alto and East Palo Alto. Since 1965, increased surface water deliveries from the Hetch Hetchy system has reduced groundwater demand and allowed the restoration of the groundwater subbasin to pre-1960 levels.

Surprisingly, the subbasin also benefits from the Alameda County Water District recharge program on the eastern side of the Bay. According to the Santa Clara Basin Watershed Management Initiative (2000), surface water spread by the District flows several hundred feet beneath the Bay and sustains groundwater pumping along the bayfront in Palo Alto, Menlo Park, East Palo Alto, and Mountain View.

The shallow groundwater in the San Francisquito Creek alluvial fan section of the subbasin extends to depths of up to 100 feet. Upstream of San Mateo Drive water levels are more than 20 feet below the creek bottom. Groundwater levels may be near the streambed just downstream of Middlefield Road and then again in the tidal reach, downstream of Highway 101 and through East Palo Alto.

The groundwater in the San Mateo Subbasin tends to be quite hard and have high concentrations of iron and manganese.

2.3 San Francisquito Watershed

The San Francisquito Creek Watershed covers approximately 45 square miles of the South Bay area, draining the east-facing slopes of the Santa Cruz Mountains through to the San Francisco Bay. The upper part of the watershed is rural and hilly, while the lower part of the watershed is urban and flat. The highest elevation in the watershed is approximately 2,200 feet.

The watershed is “probably the most inter-jurisdictionally complicated watershed in the Bay Area” (USGS 2003), enveloping the Cities of East Palo Alto, Menlo Park, Palo Alto, Portola Valley, Woodside, unincorporated areas in both San Mateo and Santa Clara Counties, and Stanford University. What’s more, San Francisquito Creek forms the county line between San Mateo and Santa Clara Counties. The watershed is approximately 80 percent in San Mateo County and 20 percent in Santa Clara County.

The San Francisquito Creek fan encompasses approximately 22 square miles. The subbasin boundaries roughly correspond to the extent of the San Francisquito Creek alluvial fan. The City of East Palo Alto lies entirely on the alluvial fan of San Francisquito Creek sharing this floodplain with the Cities of Menlo Park and Palo Alto. Historically, during floods the swollen creek would deposit sand, silt, and gravel carried from the hills across the Baylands area. For thousands of years this process, coupled with the constantly changing course of the lower streambed, built up thick, fan-shaped sedimentary deposits of sand and gravel on which East Palo Alto and its neighbors now sit.

The San Francisquito Creek subbasin is composed of coarse- and fine-grained alluvial deposits of San Francisquito Creek. The groundwater system includes a shallow aquifer and a deep aquifer beneath a laterally extensive confining clay layer. The deep aquifer consists of an upper and lower zone. The groundwater subbasin is as much as 1,000 feet thick in places. The groundwater system includes a shallow aquifer that extends from the ground surface to about 15 to 100 feet below ground surface (bgs) and a deep aquifer beneath the confining layer that has two water-bearing zones. The upper zone is between 200 and 300 feet bgs and the lower zone extends to depths greater than 300 feet bgs.

San Francisquito Creek has an inadequate carrying capacity due to development, vegetation sedimentation, land subsidence, levee settlement and erosion. Flooding on the creek affects the cities of Menlo Park and East Palo Alto in San Mateo County, and Palo Alto in Santa Clara County. As a result of record rainfall in February 1998, San Francisquito Creek overtopped its banks, affecting approximately 1,700 residential and commercial structures. Due to the flooding, the cities of Palo Alto, Menlo Park, and East Palo Alto, the County of San Mateo, and the Santa Clara Valley Water District joined together to create a regional government agency, the San Francisquito Creek Joint Powers Authority (SFCJPA). The SFCJPA plans, designs, and implements projects along the creek.

The Cities of Menlo Park and East Palo Alto commissioned a study on the San Francisquito Creek Groundwater Subbasin (Watershed). The report developed by Todd Engineers provides a preliminary feasibility level evaluation of the potential supply and quality of groundwater resources in Menlo Park and East Palo Alto.

The report determined that supplemental wells could be installed by the City of East Palo Alto and Menlo Park for irrigation and/or potable use to augment existing water supplies in case of emergency or drought. Yields from a properly designed and sited large diameter well installed in the Cities can be expected to range from approximately 300 to 1,800 gpm. The preliminary estimate of annual groundwater recharge in the San Francisquito Subbasin ranges from approximately 4,000 to 8,000 AFY. The Cities could install supplemental wells to capture some portion of this annual recharge without mining the groundwater resource.

2.3.1 Groundwater Management Plan

In September 2014, the State enacted three legislative bills (AB 1739, SB 1168, and SB 1319), more commonly known as the Sustainable Groundwater Management Act (SGMA). This legislation mandates sustainable management of groundwater resources and provides expanded powers to local public water agencies that organize as groundwater sustainability agencies. Sustainability is defined in terms of a basin’s yield as the maximum long-term quantity of water that can be withdrawn annually without causing an undesirable result.

Compliance with the Sustainable Groundwater Management Act is required for groundwater basins or subbasins that have been designated by CDWR as medium- or high priority. Although the San Mateo Subbasin is considered to be of very low priority, the City, being proactive, developed a Groundwater Management Plan for the portion of the subbasin underlying the City. The plan was finalized in November 2015 and seeks to better understand the interconnection of groundwater and surface water, monitor groundwater levels, monitor the potential risk of new contaminants, contamination migration, overdraft, salt water intrusion, and land subsidence.

3.0 WATER SYSTEM DEMANDS

The City of East Palo water is supplied from three water systems. The City managed water system receives all of its domestic water from the SFPUC. The City is able to and has drawn groundwater out of this basin, mostly through its Gloria Bay Well, but ceased using it for drinking purposes due to poor water quality. However, some groundwater is utilized for street cleaning, construction, dust-control, and other non-potable uses. PAPMWC and O'Connor Tract rely primarily on groundwater with backup connections to the City of East Palo Alto water system.

SFPUC has made available and the City has purchased water above the Individual Supply Guarantee (ISG) for several of the years since 2002. Consistent with existing agreements, this has been possible because other wholesale agencies have not used their full contractual supply. In FY2014/15, total purchases were approximately 444AF below the ISG (not including Menlo Park deliveries). This reduction in demand is primarily attributed to the ongoing drought. The following tables summarize the City water purchases from SFPUC relative to the ISG of 2,199 AFY as well as the groundwater production from the Gloria Bay well.

The City supplies water to Menlo Park for service to approximately 200 customers. The water sold to the City of Menlo Park does not count against East Palo Alto's Individual Supply Guarantee of 1.963 MGS, but against the City of Menlo Park.

Table 3-1 East Palo Alto Historical Water Use

Year (AFY)	Purchase from SFPUC[1]	Sales to Menlo Park[2]	East Palo Alto Demand/ Purchase	Under/ (Over) Allocation	Groundwater Production
2001-02	2,283	172	2,110	89	
2002-03	2,274	163	2,111	88	
2003-04	2,463	161	2,303	(104)	
2004-05	2,265	156	2,108	91	
2005-06	2,248	134	2,113	86	2
2006-07	2,437	146	2,291	(92)	3
2007-08	2,417	133	2,284	(85)	18
2008-09	2,273	126	2,147	52	1
2009-10	2,033	98	1,935	264	17
2010-11	2,106	118	1,988	211	Unknown
2011-12	2,185	97	2,088	111	Unknown
2012-13	2,325	10	2,315	(116)	Unknown
2013-14	1,660	10	1,650	535	Unknown
2014-15	1,764	9	1,755	444	Unknown
Average	**2,195**	**110**	**2,086**	**112**	

[1] *Provided by San Francisco Public Utilities Commission*
[2] *Provided by Menlo Park*

The following is the total production for O'Connor Tract including areas located outside East Palo Alto's city limit.

Table 3-2 O'Connor Tract Historical Water Use

Year	**O'Connor Tract**
2012	305
2013	307
2014	252

The majority of connections within the city are residential. Additionally, PAPMWC and O'Connor Tract serve areas outside the city limits. To determine the gallons per day usage, the City compared estimated populations within each water provider (including outside the city limits) to the total water demands of each of the water systems. Future development in East Palo Alto is likely to incorporate low water usage fixtures and landscaping for water conservation. The conservation measures should translate into water usage savings beyond the anticipated demand predicted in this WSA.

PAPMWC was contacted several times to provide data for this WSA. The City received no response. Based on GPCD usage from the two other service areas, the City assumes that the usage within the PAPMWC service area is similar to that of O'Connor Tract.

Table 3-3 Estimated Demand GPCD

Water Agency	Year	Population	Demand (AF)	GPCD
EPA	2010	22,947[1]	1,962[2]	76
PAPMWC	2010	3,484[3]	---[4]	87[4]
O'Connor Tract	2012	3,139[3]	305	87

[1] *Population from the 2010 US Census not including PAPMWC and O'Connor Tract.*
[2] *Water Deliveries provided by SFPUC from Jan 2010 to Dec 2010.*
[3] *Population from the 2010 US Census including areas outside the East Palo Alto city limits.*
[4] *PAPMWC did not provide data for this WSA. The City assumes that the usage within the PAPMWC service area is similar to that of O'Connor Tract.*

Table 3-4 2040 Projected Water Demands

	Within EPA City Limits		Total Demand[1]	
Water Agency	**Population**	**Demand (AF)**	**Population**	**Demand (AF)**
EPA	31,646	2,694	31,646	2,694
PAPMWC	3,549	346	3,613	352
O'Connor Tract	2,586	252	3,671	358
Total	**37,781**	**3,292**	**38,930**	**3,404**

[1] *Includes service area outside city limits.*

4.0 WATER SUPPLY RELIABILITY

Water supply reliability is a measure of the water provider's ability to provide an adequate water supply during times of shortage. The City has no storage and very limited to no groundwater production capacity. Therefore the City relies solely on SFPUC for its water supply. PAPMWC and O'Connor Tract rely primarily on groundwater with backup connections to the City of East Palo Alto's water system. Both the PAPMWC and O'Connor Tract have reliable storage in their system. This section discusses the reliability of the City's water supplies during single and multiple dry years.

4.1 SFPUC 2018 Interim Supply Limitation

As part of its adoption of the Water System Improvement Program in October 2008 the SFPUC Commission adopted a water supply element, the Interim Supply Limitation (ISL), to limit sales from the RWS watersheds to an average annual of 265 mgd through 2018. The wholesale customers' collective allocation under the ISL is 184 mgd and San Francisco's is 81 mgd. Although the wholesale customers did not agree to the ISL, the SFPUC Agreement provides a framework for administering the ISL.

Bay Area Water Supply and Conservation Agency (BAWSCA) has developed a strategy to address each of its member agencies' unmet needs flowing from the ISL through its Water Conservation Implementation Plan and the Long-term Reliable Water Supply Strategy, separately addressed in Section 5.4.

4.1.1 Interim Supply Allocations

The Interim Supply Allocations (ISAs) refers to each individual wholesale customer's share of the ISL. On December 14, 2010, the Commission established each agency's ISA through 2018. In general, the Commission based the allocations on the lesser of the projected fiscal year 2017-18 purchase projections or Individual Supply Guarantees. The ISAs are effective only until December 31, 2018 and do not affect the Supply Assurance or the Individual Supply Guarantees, both discussed separately herein. San Francisco's Interim Supply Allocation is 81 mgd. East Palo Alto's ISA is 1.96 mgd.

4.2 Tier 1 and Tier 2 Water Allocations

4.2.1 Tier One Drought Allocations

In July 2009, in connection with the SFPUC Agreement, the wholesale customers and San Francisco adopted a Water Supply Allocation Plan (WSAP) to allocate water from the RWS to retail and wholesale customers during system-wide shortages of 20% or less (the "Tier One Plan"). The Tier One Plan replaced the prior Interim Water Shortage Allocation Plan, adopted in 2000, which also allocated water for shortages up to 20%. The Tier One Plan also allows for voluntary transfers of shortage allocations between the SFPUC and any wholesale customer and between wholesale customers themselves. In addition, water "banked" by a wholesale customer, through reductions in usage greater than required, may also be transferred.

The Tier One Plan, which allocates water between San Francisco and the wholesale customers collectively, distributes water based on the level of shortage:

Table 4-1 Water Deliveries in SFPUC Service Area

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

The Tier One Plan will expire at the end of the term of the SFPUC Agreement, unless extended by San Francisco and the wholesale customers.

4.2.2 Tier One Drought Allocations

The wholesale customers have negotiated and adopted the "Tier Two Plan", the second component of the WSAP which allocates the collective wholesale customer share among each of the 26 wholesale customers (see Appendix H). This Tier Two allocation is based on a formula that takes multiple factors for each wholesale customer into account, including:

- Individual Supply Guarantee,
- Seasonal use of all available water supplies, and
- Residential per capita use.

The water made available to the wholesale customers collectively will be allocated among them in proportion to each wholesale customer's Allocation Basis, expressed in millions of gallons per day, which in turn is the weighted average of two components. The first component is the wholesale customer's Individual Supply Guarantee, as stated in the SFPUC Agreement, and is fixed. The second component, the Base/Seasonal Component, is variable and is calculated using the monthly water use for three consecutive years prior to the onset of the drought for each of the wholesale customers for all available water supplies. The second component is accorded twice the weight of the first, fixed component in calculating the Allocation Basis. Minor adjustments to the Allocation Basis are then made to ensure a minimum cutback level, a maximum cutback level, and a sufficient supply for certain wholesale customers.

The Allocation Basis is used in a fraction, as numerator, over the sum of all wholesale customers' Allocation Bases to determine each wholesale customer's Allocation Factor. The final shortage allocation for each wholesale customer is determined by multiplying the amount of water available to the wholesale customers' collectively under the Tier One Plan, by the wholesale customer's Allocation Factor.

The Tier Two Plan requires that the Allocation Factors be calculated by BAWSCA each year in preparation for a potential water shortage emergency. As the wholesale customers change their water use characteristics (e.g., increases or decreases in SFPUC purchases and use of other water sources, changes in monthly water use patterns, or changes in residential per capita water use), the Allocation Factor for each wholesale customer will also change. However, for long-term planning purposes, each wholesale customer shall use as its Allocation Factor, the value identified in the Tier Two Plan when adopted.

The Tier Two Plan will expire in 2018 unless extended by the wholesale customers.

4.3 Reliability of the Regional Water System

The SFPUC's WSIP provides goals and objectives to improve the delivery reliability of the RWS including water supply reliability. The goals and objectives of the WSIP related to water supply are:

Program Goal	System Performance Objective
Water Supply – *meet customer water needs in non-drought and drought periods*	• Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during non-drought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

The adopted WSIP had several water supply elements to address the WSIP water supply goals and objectives. The following provides the water supply elements for all year types and the dry-year projects of the adopted WSIP to augment all year type water supplies during drought.

4.3.1 Water Supply – All Year Types

The SFPUC historically has met demand in its service area in all year types from its watersheds. They are the:

- Tuolumne River watershed,
- Alameda Creek watershed, and
- San Mateo County watersheds.

In general, 85 percent of the supply comes from the Tuolumne River through the Hetch Hetchy Reservoir and the remaining 15 percent comes from the local watersheds through the San Antonio, Calaveras, Crystal Springs, Pilarcitos, and San Andreas Reservoirs. The adopted WSIP retains this mix of water supply for all year types.

4.3.2 Water Supply – Dry-Year Types

The adopted WSIP includes the following water supply projects to meet dry-year demands with no greater than 20 percent system-wide rationing in any one year:

- Restoration of Calaveras Reservoir capacity.
- Restoration of Crystal Springs Reservoir capacity.

- Westside Basin Groundwater Conjunctive Use.
- Water Transfer with Modesto Irrigation District (MID) / Turlock Irrigation District (TID)

In order to achieve its target of meeting at least 80 percent of its customer demand during droughts, the SFPUC must successfully implement the dry-year water supply projects included in the WSIP.

4.3.3 Projected SFPUC System Supply Reliability

The SFPUC has provided information regarding the projected RWS supply reliability for the City of East Palo Alto. This information assumes that the wholesale customers purchase 184 mgd from the RWS through 2030 and the implementation of the dry-water water supply projects included in the WSIP. The numbers represent the wholesale share of available supply during historical year types per the Tier One Water Shortage Allocation Plan. The information does not reflect any potential impact to RWS yield from the additional fishery flows required as part of Calaveras Dam Replacement Project and the Lower Crystal Springs Dam Improvements Project.

4.3.4 Impact of Recent SFPUC Actions on Dry Year Reliability of SFPUC Supplies

In adopting the Calaveras Dam Replacement Project and the Lower Crystal Springs Dam Improvements Project, the SFPUC committed to providing fishery flows below Calaveras Dam and Lower Crystal Springs Dam as well as bypass flows below Alameda Creek Diversion Dam. The fishery flow schedules for Alameda Creek and San Mateo Creek represent a potential decrease in available water supply of an average annual 3.9 mgd and 3.5 mgd, respectively with a total of 7.4 mgd average annually. These fishery flows could potentially create a shortfall in meeting the SFPUC demands of 265 mgd and slightly increase the SFPUC's dry-year water supply needs.

The adopted WSIP water supply objectives include (1) meeting a target delivery of 265 mgd through 2018 and (2) rationing at no greater than 20 percent system-wide in any one year of a drought. As a result of the fishery flows, the SFPUC may not be able to meet these objectives between 2013 and 2018 without (1) a reduction in demand, (2) an increase in rationing, or (3) a supplemental supply. The following describes these actions.

Reduction in Demand

The current projections for purchase requests through 2018 remain at 265 mgd. However, in the last few years, SFPUC deliveries have been below this level, as illustrated below. If this trend continues, the SFPUC may not need 265 mgd from its watersheds to meet purchase requests through 2018. As a result, the need for supplemental supplies of 3.5 mgd starting in 2013 and increasing to 7.4 mgd in 2015 to offset the water supply loss associated with fish releases may be less than anticipated.

Table 4-2 Past Water Deliveries in SFPUC Service Area[1]

	FY2006	FY 2007	FY 2008	FY 2009	FY 2010
Total Deliveries (mgd)	247.5	257	254.1	243.4	225.2

Increase in Rationing

The adopted WSIP provides for a dry year water supply program that, when implemented, would result in system-wide rationing of no more than 20 percent. The PEIR identified the following drought shortages during the design drought; 3.5 out of 8.5 years at 10 percent rationing and 3 out of 8.5 years at 20 percent. If the SFPUC did not develop a supplemental water supply in dry years to offset the effects of the fishery flows on water supply, rationing would increase during dry years. If the SFPUC experiences a drought between 2013 and 2018 in which rationing would need to be imposed, rationing would increase by approximately 1 percent in shortage years. Rationing during the design drought would increase by approximately 1 percent in rationing years.

Supplemental Supply

The SFPUC may be able to manage the water supply loss associated with the fishery flows through the following actions and considerations:

- Development of additional conservation and recycling.
- Development of additional groundwater supply.
- Water transfer from MID and/or TID.
- Increase in Tuolumne River supply.
- Revising the Upper Alameda Creek Filter Gallery Project capacity[2].
- Development of a desalination project.

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[1] Reference: SFPUC FY09-10 J-Table Line 9 "Total System Usage" plus 0.7 mgd for Lawrence Livermore National Laboratory use and 0.4 mgd for Groveland. No groundwater use is included in this number. Unaccounted-for-Water is included.

[2] The adopted WSIP included the Alameda Creek Fishery Enhancement project, since renamed the Upper Alameda Creek Filter Gallery (UACFG) project, which had the stated purpose of recapturing downstream flows released under a 1997 California Department of Fish and Game MOU. Implementation of the UACFG project was intended to provide for no net loss of water supply as a result of the fishery flows bypassed from ACDD and/or released from Calaveras Dam. At the time the PEIR was prepared, the UACFG was described in the context of recapturing up to 6300 AF per year. The UACFG will undergo a separate CEQA process in which all impacts associated with the project will be analyzed fully.

4.3.5 Meeting the Level of Service Goal for Delivery Reliability

The SFPUC has stated a commitment to meeting its contractual obligation to its wholesale customers of 184 mgd and its delivery reliability goal of 265 mgd with no greater than 20 percent rationing in any one year of a drought. In Resolution No. 10-0175 adopted by the Commission on October 15, 2010, the Commission directed staff to provide information to the Commission and the public by March 31, 2011 on how the SFPUC has the capability to attain its water supply levels of service and contractual obligations. This directive was in response to concerns expressed by the Commission and the Wholesale Customers regarding the effect on water supply of the instream flow releases required as a result of the Lower Crystal Springs Dam Improvement Project and the Calaveras Dam Replacement Project. In summary, the SFPUC has a projected shortfall of available water supply to meet its LOS goals and contractual obligations. The SFPUC has stated that current decreased levels of demand keep this from being an immediate problem, but that in the near future, the SFPUC must resolve these issues. Various activities are underway by the SFPUC to resolve the shortfall problem.

4.4 Reliability of the Regional Water System

BAWSCA's water management objective is to ensure that a reliable, high quality supply of water is available where and when people within the BAWSCA service area need it. A reliable supply of water is required to support the health, safety, employment, and economic opportunities of the existing and expected future residents in the BAWSCA service area and to supply water to the agencies, businesses, and organizations that serve those communities. BAWSCA is developing the Long-Term Reliable Water Supply Strategy (Strategy) to meet the projected water needs of its member agencies and their customers through 2035 and to increase their water supply reliability under normal and drought conditions.

The Strategy is proceeding in three phases. Phase I was completed in 2010 and defined the magnitude of the water supply issue and the scope of work for the Strategy. Phase II of the Strategy was completed in 2014 and resulted in a refined estimate of when, where, and how much additional supply reliability and new water supplies are needed throughout the BAWSCA service area through 2035, as well as a detailed analysis of the water supply management projects, and the development of the Strategy implementation plan. Phase III will include the implementation of specific water supply management projects. Depending on cost-effectiveness, as well as other considerations, the projects may be implemented by a single member agency, by a collection of the member agencies, or by BAWSCA in an appropriate timeframe to meet the identified needs.

The development and implementation of the Strategy will be coordinated with the BAWCSA member agencies and will be adaptively managed to ensure that the goals of the Strategy (i.e., increased normal and drought year reliability) are efficiently and cost-effectively being met.

4.5 East Palo Alto Supply Reliability

When the SFPUC declares a water shortage, East Palo Alto may be required to make water use cutbacks. Table 5-3 shows the current level of water supply reliability based on a set of operational, engineering, and hydrological assumptions from SFPUC. East Palo Alto has a contractual Individual Supply Guarantee of 2,199 AFY, this amount is not an absolute guarantee. In times of shortage, SFPUC will provide less than the assurance.

Table 4-3 SFPUC Supply Reliability

Water supply sources	Purchase Year 2010	One Critical Dry Year	Multiple Dry Water Year Supply		
			Year 1	Year 2	Year 3
SFPUC System-Wide Shortage (%)		10	10	20	20
SFPUC Wholesale Allocation (AFY)	206,106	170,934	170,934	148,419	148,419
East Palo Alto Allocation Factor		1.39	1.39	1.39	1.39
City of East Palo Alto Allocation (AFY)	2,033	2,033	2,033	2,033	2,033
Percent of Water Supply Assurance	100	100	100	100	100

Wholesale water demands were very low relative to available supply throughout the Hetch-Hetchy System in 2010. Based on information provided by the SFPUC and application of the Tier 1 Drought Allocation Plan and the DRIP, our projected drought allocations from the SFPUC in 2010 and immediately thereafter are actually greater than our 2010 purchases of 1.81 mgd (e.g., our agency is projected to receive up to 2.1 mgd under a 10% system-wide rationing, and 1.8 mgd under a 20% system-wide rationing). As such, the City of East Palo Alto has shown that in 2010, even under extended drought conditions, we are able to get 100% of our SFPUC purchase projections.

Source: SFPUC letter to Nicole Sandkulla dated March 31, 2011. The Allocation Factor is based on the current Tier 2 Drought Implementation Plan (DRIP) value of 1.39%. The Allocation Factor will be recalculated by BAWSCA each year as it is based on a variety of factors including historical water purchases over last 3 years. The drought frequency percentages are based on a repeat of the actual historic hydrologic period 1920 through 2002. In 9.6% of years (8 out of 83), there will be at least a 10 percent system-wide cutback based on this information.

4.6 Groundwater Quality

The groundwater in East Palo Alto has high levels of total dissolved solids (TDS), nitrate, iron and manganese. The United States Environmental Protection Agency standards for drinking water fall into two categories—Primary Standards and Secondary Standards. Elevated levels of these constituents make groundwater undesirable for potable use for aesthetic reasons.

TDS, nitrate, Iron and manganese are both classified under the Secondary Maximum Contaminant Level (SMCL) standards. The SMCL for iron in drinking water is 0.3 milligrams per liter (mg/L) and 0.05 mg/L for manganese. The SMCL for TDS is 500 mg/L with an upper limit of 1,000 mg/L and the SMCL for chloride is 250 mg/L.

Several of the wells in the area exceed the TDS SMCL of 500 mg/L, including the City's Gloria Way Well which had concentrations as high as 840 and the nearby wells of PAPMWC which have slightly lower concentrations. Additionally, chloride levels exceeding the SMCL have been found in the City's Gloria Way Well as high as 350 mg/L. Several wells have manganese concentrations exceeding the SMCL. The City's Gloria Way Well has had manganese concentrations as high as 0.19 mg/L. Some of the nearby PAPMWC and O'Connor Tract wells also have had manganese concentrations above the SMCL.

Although the wells in the area exceed these SMCL's the groundwater in the area is acceptable for potable and irrigation uses.

5.0 WATER SUPPLY ANALYSIS

The available supplies and water demands for East Palo Alto's service area were analyzed to assess the region's ability to satisfy demands during three scenarios for the water systems: a normal water year, single dry-year and multiple dry-years. The tables in this section present the supplies and demands for the various drought scenarios for the projected planning period of 2015-2040 in five year increments.

Table 5-1 Supply and Demand Comparison Normal Water Year

	2015		2020		2025		2030		2035		2040	
	City	Total	City	Total	City	Total	City	Total	City	Total	City	Total
Supply totals												
American Water	2,199	2,199	2,199	2,199	2,199	2,199	2,199	2,199	2,199	2,199	2,199	2,199
PAPMWC	331	337	334	340	337	343	340	346	343	349	346	352
O'Connor Tract	230	321	234	328	239	335	243	342	247	350	252	358
Demand totals												
American Water	2,106	2,106	2,208	2,208	2,317	2,317	2,434	2,434	2,559	2,559	2,694	2,694
PAPMWC	331	337	334	340	337	343	340	346	343	349	346	352
O'Connor Tract	230	321	234	328	239	335	243	342	247	350	252	358
Surplus or (Shortfall)												
American Water	93	93	(9)	(9)	(118)	(118)	(235)	(235)	(360)	(360)	(495)	(495)
PAPMWC	0	0	0	0	0	0	0	0	0	0	0	0
O'Connor Tract	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-2 gives the city's single dry-year water supply reliability scenario for the years 2015, 2020, 2025, 2030, and 2035:

Table 5-2 Supply and Demand Comparison During Single Dry-Years

	2015		2020		2025		2030		2035		2040	
	City	Total	City	Total	City	Total	City	Total	City	Total	City	Total
Supply totals												
American Water	2,033	2,033	2,033	2,033	2033	2,033	2,033	2,033	2,033	2,033	2,033	2,033
PAPMWC	331	337	334	340	337	343	340	346	343	349	346	352
O'Connor Tract	230	321	234	328	239	335	243	342	247	350	252	358
Demand totals												
American Water	2,106	2,106	2,208	2,208	2,317	2,317	2,434	2,434	2,559	2,559	2,694	2,694
PAPMWC	331	337	334	340	337	343	340	346	343	349	346	352
O'Connor Tract	230	321	234	328	239	335	243	342	247	350	252	358
Surplus or (Shortfall)												
American Water	(73)	(73)	(175)	(175)	(284)	(284)	(401)	(401)	(526)	(526)	(661)	(661)
PAPMWC	0	0	0	0	0	0	0	0	0	0	0	0
O'Connor Tract	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-3 through 5-5 gives the city's multiple dry-year water supply reliability scenario for the years 2015, 2020, 2025, 2030, and 2035:

Table 5-3 Supply and Demand Comparison During Multiple Dry-Years (First Year)

	2015		2020		2025		2030		2035		2040	
	City	Total	City	Total	City	Total	City	Total	City	Total	City	Total
Supply totals												
American Water	*2,033*	*2,033*	*2,033*	*2,033*	*2033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Demand totals												
American Water	*2,106*	*2,106*	*2,208*	*2,208*	*2,317*	*2,317*	*2,434*	*2,434*	*2,559*	*2,559*	*2,694*	*2,694*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Surplus or (Shortfall)												
American Water	*(73)*	*(73)*	*(175)*	*(175)*	*(284)*	*(284)*	*(401)*	*(401)*	*(526)*	*(526)*	*(661)*	*(661)*
PAPMWC	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
O'Connor Tract	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table 5-4 Supply and Demand Comparison During Multiple Dry-Years (Second Year)

	2015		2020		2025		2030		2035		2040	
	City	Total	City	Total	City	Total	City	Total	City	Total	City	Total
Supply totals												
American Water	*2,033*	*2,033*	*2,033*	*2,033*	*2033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Demand totals												
American Water	*2,106*	*2,106*	*2,208*	*2,208*	*2,317*	*2,317*	*2,434*	*2,434*	*2,559*	*2,559*	*2,694*	*2,694*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Surplus or (Shortfall)												
American Water	*(73)*	*(73)*	*(175)*	*(175)*	*(284)*	*(284)*	*(401)*	*(401)*	*(526)*	*(526)*	*(661)*	*(661)*
PAPMWC	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
O'Connor Tract	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table 5-5 Supply and Demand Comparison During Multiple Dry-Years (Third Year)

	2015		2020		2025		2030		2035		2040	
	City	Total	City	Total	City	Total	City	Total	City	Total	City	Total
Supply totals												
American Water	*2,033*	*2,033*	*2,033*	*2,033*	*2033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*	*2,033*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Demand totals												
American Water	*2,106*	*2,106*	*2,208*	*2,208*	*2,317*	*2,317*	*2,434*	*2,434*	*2,559*	*2,559*	*2,694*	*2,694*
PAPMWC	*331*	*337*	*334*	*340*	*337*	*343*	*340*	*346*	*343*	*349*	*346*	*352*
O'Connor Tract	*230*	*321*	*234*	*328*	*239*	*335*	*243*	*342*	*247*	*350*	*252*	*358*
Surplus or (Shortfall)												
American Water	*(73)*	*(73)*	*(175)*	*(175)*	*(284)*	*(284)*	*(401)*	*(401)*	*(526)*	*(526)*	*(661)*	*(661)*
PAPMWC	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
O'Connor Tract	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

6.0 CONCLUSION

The Proposed Project is estimated to increase water demand within the City by 831 acre feet by the year 2040 based on review of information submitted by the water purveyors. This demand is a 34 percent increase from the current demand. The City SFPUC supply is limited by its contractual limitations while the groundwater basin is not adjudicated and there are currently no groundwater pumping restrictions. As shown in this assessment, the City's existing water supplies are not sufficient to meet the demands associated with this Proposed Project. In order for the demands associated with the Proposed Project to be met during normal and dry years, new water supplies must be acquired and developed.

Due to the predicted shortfall, the City should look at several potential new water supplies to meet the demands for the proposed future growth for the Proposed Project.

Groundwater Opportunities

The City owns the Gloria Bay Well which has high levels of total dissolved solids, nitrate, arsenic, iron and manganese. The City is considering plans to redevelop the Gloria Bay Well and install a new groundwater well (Pad D) and treat the groundwater to meet California drinking water standards. East Palo Alto may need to install an iron and manganese treatment facility with storage reservoirs for blending with the Hetch Hetchy surface water supply.

Transfer and Exchange Opportunities

The SFPUC Agreement allows for the transfer or exchange of water among parties, both inside and outside of the RWS. Within the SFPUC system, it is possible to transfer ISG and/or unused portions of water allocations among contracting agencies. The Water Shortage Allocation Plan (WSAP) adopted by SFPUC and its wholesale customers provides for voluntary transfers of water among wholesale customers during periods when mandatory rationing is in effect within the RWS. Some wholesale customers have the capacity to draw more heavily on other water supplies, such as the State Water Project or groundwater and may be willing to transfer a portion of their ISG to other customers.

Both the SFPUC Agreement and state law also allow purchase and transfer of water from outside the SFPUC service area. As permitted by the SFPUC Agreement and state law, water may be purchased from outside of the RWS and conveyed to SFPUC and/or East Palo Alto through third-party transmission systems. Additional water could be secured either by SFPUC or East Palo Alto to augment its water supply. Such an arrangement would require both a contract with the third-party water supplier and an agreement between East Palo Alto and the SFPUC on the water quality, price, and operational terms.

In additional to acquiring transferred water individually, BAWSCA has statutory authority to assist the wholesale customers of the Hetch Hetchy regional water system to plan for and acquire supplemental water supplies.

Recycled Water Opportunities

The City of East Palo Alto is served by two wastewater districts—the East Palo Alto Sanitary District (EPASD) and the West Bay Sanitary District (WBSD)—which transport wastewater out of the city boundaries. Both districts overlie areas of the city served by the East Palo Alto water system; though EPASD covers by far the majority of the City's service area while WBSD covers a small portion of the City. EPASD delivers its wastewater to the City of Palo Alto's Regional Water Quality Control Plant (RWQCP) and WBSD delivers its wastewater to the South Bayside System Authority Regional Treatment Plant (SBSARTP) in San Carlos.

Currently, there is no use of recycled water within the City of East Palo Alto. All wastewater for the city is conveyed outside the city limits and treated by the wastewater treatment facilities serving the Cities of Palo Alto and Redwood City. These two facilities receive all of the wastewater produced by East Palo Alto. The facilities provide full treatment capacity to prepare recycled water, which is then reused in Redwood City and in northern Santa Clara County, but there is no infrastructure in place to transfer recycled wastewater back into East Palo Alto.

Both the RWQCP and SBSARTP put a portion of their wastewater streams through primary, secondary, and advanced (tertiary) stages of treatment to meet recycled water standards for unrestricted beneficial reuse per California Code of Regulations, Title 22 and the remaining through standards for restricted use. Both plants deliver this highly treated wastewater for reuse in certain sections of their service area.

Recycled water could be used to irrigate parks, landscape mediums, and other non-potable uses which would free up potable water for future development including the Proposed Project.

In order to access recycled water, the City of East Palo Alto would have to connect to the SBSA or the Palo Alto Sanitary District recycled water lines. Additional infrastructure would be needed to get the recycled water to the place of use within the City limits.

7.0 DOCUMENTATION REVIEW

The following list identifies additional documentation that has been relied upon to prepare this WSA:

Army Corps of Engineers, September 2005, *San Francisquito Creek Flood Damage Reduction & Ecosystem Restoration General Investigations Program San Mateo & Santa Clara Counties, Ca Proposed Feasibility Phase Project Management Plan.*

California Department of Water Resources, 2004. "Santa Clara Valley Groundwater Basin, San Mateo Subbasin." *California's Groundwater Bulletin 118.*

City and County of San Francisco. July 2009. *Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County.*

City of East Palo Alto, 1999. *City of East Palo Alto General Plan: December 1999*. Assisted by Cotton/Beland/Associates, Inc., and Dinwiddie & Associates.

City of Menlo Park, 2014, General Plan Update – Housing Element. Assisted by Jeffery Baird, Baird + Driskell Community Planning.

Department of Water Resource, 2003, California's Groundwater Bulletin 118.

Department of Water Resource, 2004, California's Groundwater Bulletin 118. Santa Clara Valley Groundwater Basin, San Mateo Subbasin

HDR, April 2004. *Gloria Way Well Investigation Summary Report.*

Integrated Resource Management, Inc., July 2011. *City of East Palo Alto 2010 Urban Water Management Plan*.

Integrated Resource Management, Inc., October 2010. *City of East Palo Alto Water System Master Plan*.

Integrated Resource Management, LLC., 2005. *City of East Palo Alto Urban Water Management Plan 2005*.

Todd Engineers, August 2005. *Feasibility of Supplemental Groundwater Resources Development, Menlo Park and East Palo Alto, California.*

Todd Engineers, 2012. *Gloria Way Water Well Production Alternatives Analysis & East Palo Alto Water Security Feasibility Study, November 2012.*