DRAFT ENVIRONMENTAL IMPACT REPORT
GRAPEVINE PROJECT
SCH# 2013031078

Volume 2 - Appendices

City of Delano – March 28, 2014

BSK Associates
Engineers & Laboratories

DRAFT ENVIRONMENTAL IMPACT REPORT
FOR THE
GRAPEVINE PROJECT
CITY OF DELANO, KERN COUNTY

VOLUME 2 - APPENDICES

STATE CLEARINGHOUSE No. SCH2013031078

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March 28, 2014

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APPENDIX 1.0

NOTICE OF PREPARATION AND COMMENTS

NOTICE OF PREPARATION

To: Office of Planning and Research, Responsible and Trustee Agencies, Cities and Counties bordering Delano, and other Interested Individuals and Organizations

Subject: Notice of Preparation of a Draft Environmental Impact Report

Lead Agency: City of Delano

Project Title: The Grapevine Project

Project Applicant: YK America

Date: March 27, 2013

Notice is hereby given that the City of Delano, California, will be the Lead Agency and will prepare a Draft Environmental Impact Report (EIR) for The Grapevine Project (proposed project) shopping center development. The Lead Agency has prepared this Notice of Preparation (NOP) in order to provide the opportunity for comments from all interested parties, organizations, and agencies on the scope of the environmental analysis addressing the potential effects of the proposed project.

Several discretionary actions are required by the Lead Agency for the proposed project and, therefore, it is subject to the California Environmental Quality Act (CEQA). The Lead Agency has prepared an Initial Study (IS), pursuant to CEQA, to determine whether, based on substantial evidence, the proposed project may have a significant adverse effect on the environment. CEQA requires an EIR to be prepared if substantial evidence indicates that the proposed project may result in significant impacts that cannot be mitigated, or if a project involves considerable public controversy. The results of the attached IS show that the proposed project may result in significant impacts.

A range of reasonable alternatives to the proposed project will be assessed in the project EIR to meet CEQA Guidelines Section 15126.6. Alternatives to be evaluated in the EIR will include a "No Project" alternative, and other alternatives designed to reduce the proposed project's significant environmental impacts.

In order for the public and agencies to have an opportunity to ask questions and submit comments on the scope of the EIR, a *public scoping meeting* will be held as follows:

Thursday, April 25, 2013, from 5:30 p.m. to 7:30 p.m. in the Delano Civic Center located at 1009 11th Avenue, Delano CA 93215

Meeting facilities are accessible to persons with disabilities. If you require special assistance to participate in the public scoping meeting, please notify the Community Development Department at (661) 721-3340 at least 48 hours prior to the meeting.

A copy of the NOP/IS for the proposed project is attached or can be found at these locations:

- City of Delano Community Development Department website - http://www.CityofDelano.org/
- City of Delano Community Development Department, 1005 11th Avenue, Delano CA 93215

Written responses including any questions or comments must be received *no later than 30 days* after publication of this notice, **by 4:00 p.m. on Monday, April 29, 2013**. Please send your written responses to the: **Community Development Department, City of Delano, P.O. Box 3010, 1005 11th Avenue, Delano, CA 93215 or email to: rcarino@cityofdelano.org**

Signature: _____ March 27, 2013

Title: Richelle Carino, Community Development Director **Date:**

(661) 721-3340 (office)
(661) 721-3298 (fax)

SECTION 1. LOCATION AND BACKGROUND INFORMATION

The project site is located in the City of Delano, in northern Kern County, California. Delano is located along State Route 99, approximately 30 miles northwest of the City of Bakersfield and 78 miles southeast of the City of Fresno. Located in the southern portion of California's agriculturally rich San Joaquin Valley, the City of Delano is ten miles from the western foothills of the Sierra Nevada Mountains and approximately 25 miles from the Coast Range to the west.

PROJECT SITE AND IMMEDIATE VICINITY

The project site is approximately 44.64 acres in area and is comprised of one parcel, identified as Assessor's Parcel Number (APN) 521-010-21, located east of Albany Street (Stradley Avenue), west of Dover Parkway, south of Morse Boulevard, and north of Woollomes Avenue. The project site is relatively level with an elevation of approximately 300 feet above mean sea level and slopes gently in the southwest direction. The project's location is shown in **Figure 1, Project Vicinity**, and an aerial photograph is provided in **Figure 2, Site Area**.

The project site has a land use designation of "Commercial" on the Land Use Element Map of the City of Delano General Plan. The site is currently zoned as Community Retail Commercial (CRC) and General Commercial (GC) per the City of Delano Zoning Map.

SURROUNDING LAND USES

The project site is located on the southwestern edge of Delano's City limits. The adjacent property to the east includes vacant land and a Home Depot store. They are designated as "Commercial" and zoned "General Commercial" (GC). The area bordering the project site on the west is future residential development. Land to the south is future commercial and residential development. To the north are Tracts 6326 and 6327 consisting of 261 undeveloped single family residential lots.

PROJECT RELATIONSHIP TO EXISTING PLANNING DOCUMENTS

The project is consistent with both its General Plan and zoning designations. The project site is designated as "Commercial" on the Land Use Element map of the City of Delano General Plan (2005). According to the City of Delano General Plan Land Use Element, "community commercial" uses "of 10 acres and larger, should be located along major traffic ways in consolidated centers that utilize common access and parking for commercial uses." More specifically, the General Plan provides, "New centers are proposed for Woollomes/State Route 99 and at Garces Highway and Browning Road." The Grapevine Project will be located in such an area.

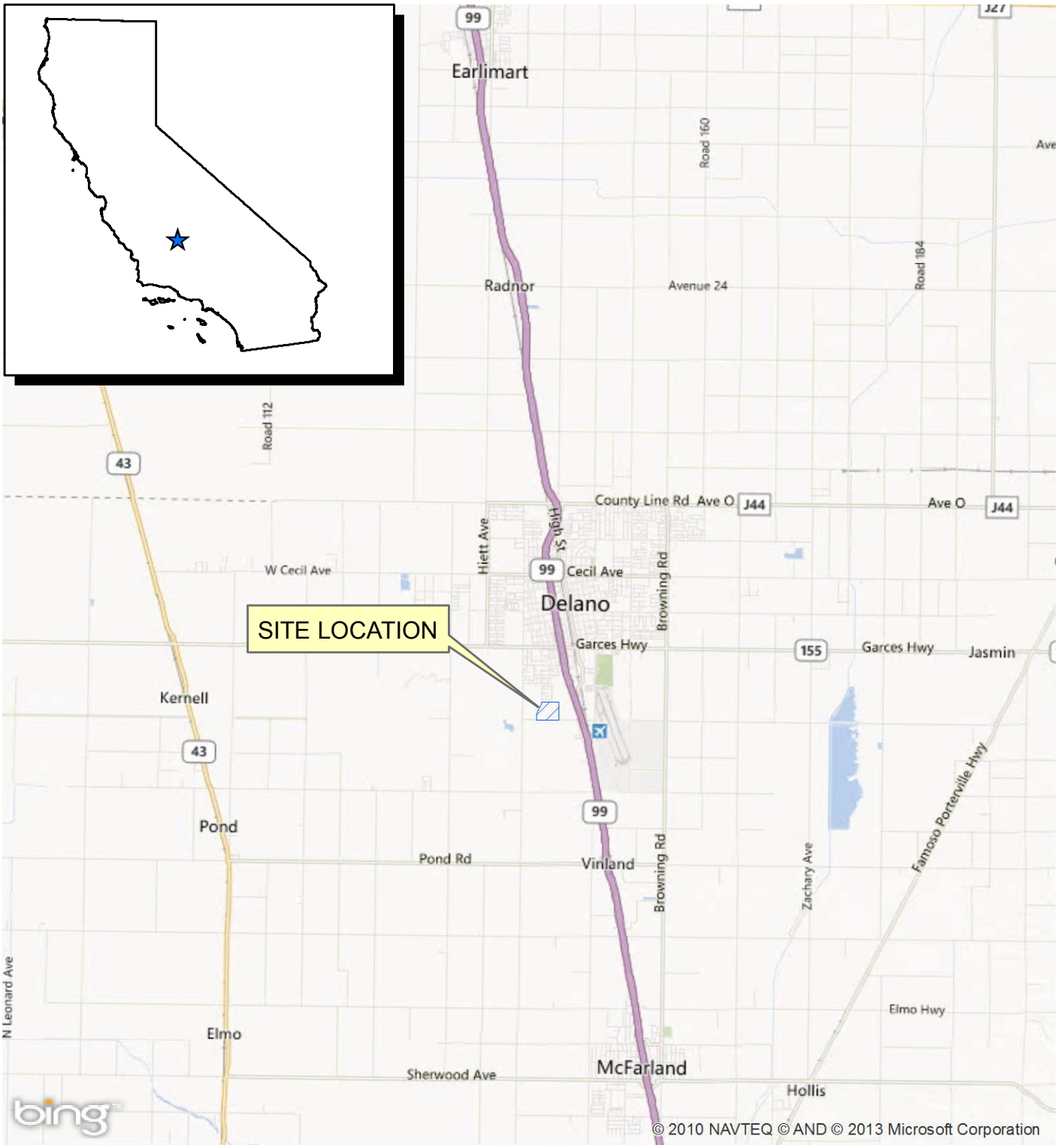
The Grapevine Project will be located on Woollomes Avenue near State Route 99. It is clustered with other commercial centers that share public infrastructure. To the east is an existing Home Depot store. Across Woollomes Avenue to the south is the Delano Marketplace, an approved regional shopping center located at the southwest corner of the intersection of Woollomes Avenue and State Route 99 that is presently under construction.

The project is also consistent with its zoning designations. The site is currently zoned **General Commercial** (GC) and **Community Retail Commercial** (CRC) per the City of Delano Official Zoning Map (2012). According to the City of Delano Zoning Ordinance, "The primary purpose of the GC District is to provide sites for commercial uses that will serve a large segment of the population with a wide variety of retail, wholesale, service, and office uses" (Delano Municipal Code §20.5.20). The Grapevine Project will provide a variety of retail goods and services to a large segment of the population located within and outside of Delano. The City of Delano's Development Code further provides that "[t]he primary purpose of the Community Retail Commercial (CRC) zone district is to provide appropriate regulations and suitable locations for…commercial uses requiring large parcels." As described above, City policy promotes a large "community commercial" center of 10 acres and larger at this location, which is consistent with these zoning designations.

PROJECT OBJECTIVES

The Project will serve the following objectives:

- To develop a retail project on the subject property that is consistent with the City of Delano General Plan;
- To provide commercial development that can be adequately served by public services and utilities in a feasible manner;
- To substantially reduce sales dollar leakage out of the City of Delano;
- To provide a commercial retail shopping center on a large, undeveloped lot in close proximity to an existing highway, near other commercial services and residential areas, in order to minimize vehicle travel distances and to utilize existing infrastructure to the fullest extent possible;
- To provide a retail development that meets the current unmet demand for goods and services from consumers residing in the trade area for the City of Delano and from future residential developments;
- To provide a commercial retail shopping center that serves both the local and regional market area to attract new customers and retailers into the City of Delano;
- To provide a commercial development that results in a net fiscal benefit to the City of Delano by generating new sales tax revenue from Delano residents, and by increasing property tax revenues;
- To provide a commercial development that can capture existing "pass-by" trips on State Route 99, thereby bringing new revenue to the City of Delano;
- To provide goods and services at a local site, thereby reducing the number of vehicle trips currently being made to shop for the same goods and services at neighboring cities;
- To provide for a multi-screen movie theater entertainment venue in combination with a shopping experience with the goal of reducing vehicle trips; and
- To provide a commercial development that creates new jobs for City residents.



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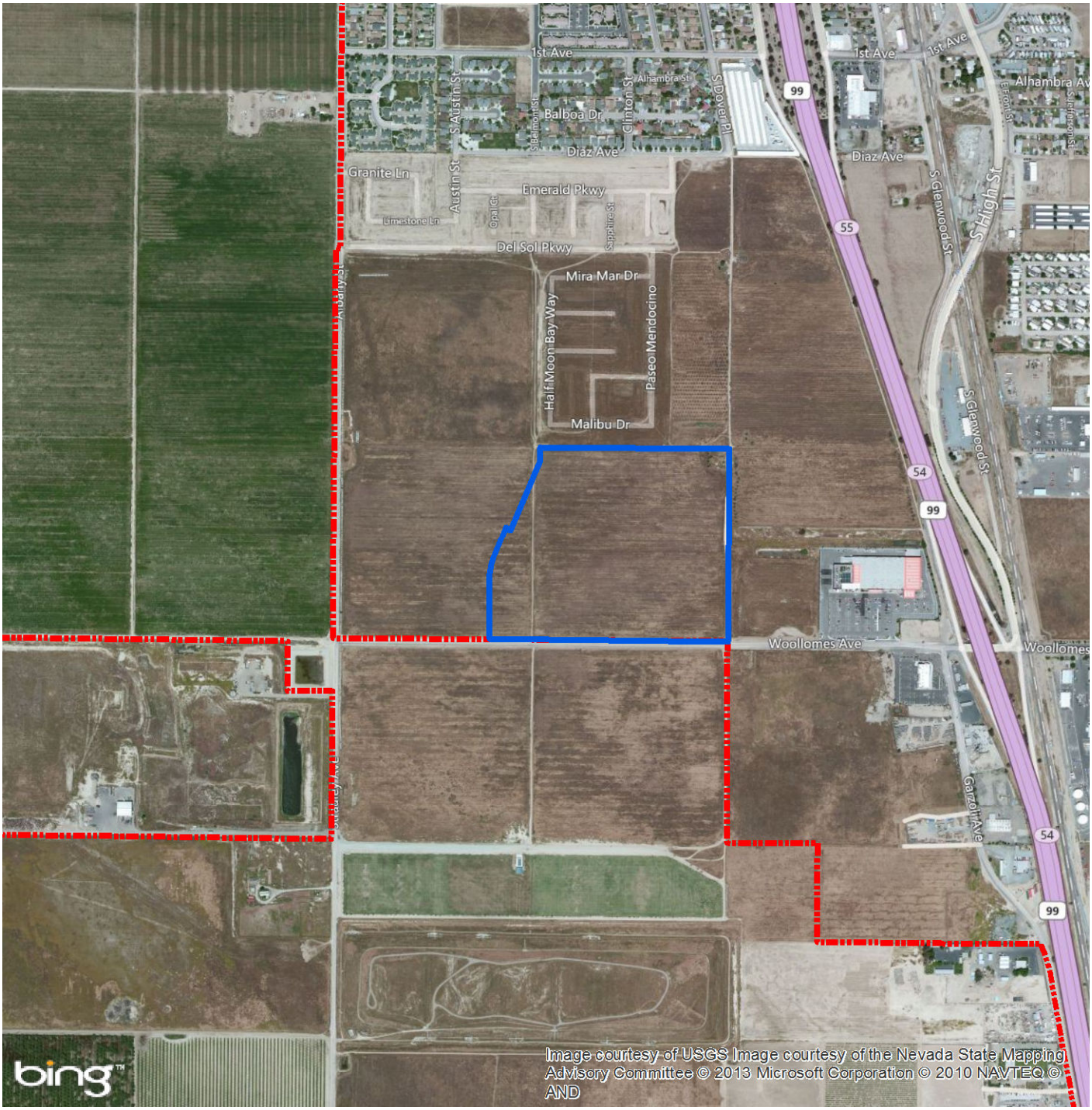
BSK Associates Engineers & Laboratories

The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

FIGURE 1
VICINITY MAP
BSK Project E1300901S



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Legend

Site Area

Delano City Limits

BSK Associates Engineers & Laboratories

The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

FIGURE 2
SITE AREA
BSK Project E1300901S

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SECTION 2. PROJECT DESCRIPTION

The project applicant submitted to the City an application for an approximately 328,500-square-foot shopping center. The proposed project would include a 12-screen theater; a lifestyle component to include retail shops and restaurants (sit-down and fast-food); mid-size retailers between 10,000 to 25,000 square feet and outparcels for fast food; and drive through and sit down restaurants, with proposed building sizes ranging from 2,500 to 10,000 square feet. The site plan for the proposed project is shown in **Figure 3, Site Plan.**

The height of the majority of the buildings at the project site would fall between 20 and 40 feet with some buildings reaching a height of 50 feet for an architectural feature. Illuminated signs of up to 80 feet in height will also be used to publicize the proposed shopping center.

OPERATIONS

Employees: The proposed project would provide approximately 617 full-time-equivalent jobs.

Hours of Operation: Normal operation would be 6:00 a.m. to 10:00 p.m., Mondays through Saturdays, and approximately 7:00 a.m. to 8:00 p.m. on Sundays. A select few users would operate 24 hours a day. A majority of the retail stores and restaurants would not open earlier than 6:00 a.m. and close no later than 11:00 p.m. The largest user, Cinemark Theater, will primarily operate during non-peak hours, thereby reducing impacts to circulation facilities and public utilities during peak user period.

Deliveries: Deliveries to the retail stores and restaurants are anticipated to occur during normal store operations.

INFRASTRUCTURE COMPONENTS AND OFF-SITE IMPROVEMENTS

Site Access and On-Site Circulation: The proposed project will be served via four streets that define the project boundary: Woollomes Avenue to the south, Dover Parkway to the east, Morse Boulevard to the north, and Albany Street (Stradley Avenue) to the west. Various levels of street improvements will be made to facilitate traffic circulation for this development.

Parking: The proposed project includes approximately 2,512 parking spaces.

UTILITIES

The proposed project will connect to the existing sanitary sewer and domestic water mains in the vicinity of the project site.

Water: The project site would be provided water service though an existing 12-inch water line, which runs along Woollomes Avenue; additional water service infrastructure improvements will be constructed on-site. All water lines will be constructed in accordance with the standards of the City of Delano.

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BSK Associates Engineers & Laboratories

The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

FIGURE 3
SITE PLAN
BSK Project E1300901S

Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Figure 3 site plan.mxd

Wastewater: Sanitary sewer service to the project site is to be provided through an existing 18-inch sewer line running along Woollomes Avenue. Wastewater improvements will be constructed in accordance with Delano City standards.

Storm water: Storm drainage from the proposed project will be directed to an existing 72-inch line, which empties into an existing unlined storm water retention basin with a capacity of approximately 100 acre-feet owned by the City of Delano, located west of Stradley Avenue.

ACTIONS TO IMPLEMENT THE PROJECT

The City of Delano, as Lead Agency under CEQA, has approval authority and responsibility for considering the environmental effects of the proposed project. Actions to be taken relative to the project may include, but not be limited to, the following items:

- Environmental Certifications
- Conditional Use Permit
- Subdivision Map
- Master Site Plan
- Architectural and Site Approval
- Master Sign Program
- Consistency Assessment
- Encroachment Permit for all work in the City/County rights-of-way
- All Final Improvement Plans
- Grading and Building Permits
- Any additional Variances
- Any related subsequent actions to implement the development

SECTION 3. ENVIRONMENTAL EFFECTS

The environmental factors checked below would be potentially affected by this project. Please see the checklist beginning on the next page for additional information.

☒	Aesthetics	☒	Agriculture and Forestry	☒	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	☒	Mandatory Findings of Significance

LEAD AGENCY DETERMINATION:

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Richelle Carino, Community Development Director

March 27, 2013
Date

1. AESTHETICS Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?			x	
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				x
c) Substantially degrade the existing visual character or quality of the site and its surroundings?			x	
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?		x		

Discussion:

a, c, d - Planned implementation of the proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as on and off-site traffic improvements. The height of the majority of the buildings at the project site would fall between 20 and 40 feet with some buildings reaching a height of 50 feet for an architectural feature. Lighted signs up to 80 feet in height are also proposed to advertise the development.

The project site, located on the southwestern edge of the Delano's City limits, is relatively level undeveloped land with little to no lighting. The project area is characterized by vacant or currently developing properties that are planned for commercial and residential uses. Due to the relatively level topography, views in the area include surrounding land uses as well as distant views of the Sierra Nevada.

The City of Delano General Plan (City of Delano, 2005; page 6-5) presents community development policies to "*Ensure that all commercial development is attractive and of high-quality design, to enhance the image of the City*." The General Plan also provides design standards to encourage sound site planning and design for both on- and off-site features. An assessment of the proposed project's conformance with the City policies and design standards will be provided in the EIR land use section.

The project EIR section on aesthetics and visual resources will address project impacts as measured against the existing setting and visual conditions in the project area. Issues of local importance to be explored in the EIR include project visibility, scale, design, light and glare impacts, and effects upon community character. Proposed new structures have the potential to affect scenic views, change the character of the site, and to create a new source of light and glare in the area. These potential visual impacts resulting from the project will be analyzed, with emphasis on changes in views as seen from adjacent lands and surrounding areas, including views from State Route 99.

b - The State Scenic Highway System includes a list of highways that are either eligible for designation as scenic highways or have been officially designated. These highways, identified in Section 263 of the Streets and Highways Code, do not include any highways in proximity to the City of Delano (Caltrans, 2013). Accordingly, there would be no aesthetic impacts within a state scenic highway corridor. This will not be addressed further in the EIR.

2. AGRICULTURE AND FOREST RESOURCES In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	x			
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				x
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				x
d) Result in the loss of forest land or conversion of forest land to non-forest use?				x
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	x			

Discussion:

a, e – Planned implementation of the proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as some off-site improvements. The EIR will examine the local soils, historic and current land use patterns of the project site as relevant to agricultural potential. The property will be compared to soils maps to determine whether the proposal will affect or convert prime or important farmland. Agricultural resources will be evaluated to determine if the proposed conversion of farmland constitutes a significant agricultural impact or constitutes a conversion of "Prime Farmland, Unique Farmland or Farmland of Statewide Importance" (per standards set forth in the CEQA Guidelines).

b, c, d – The approximately 45-acre project site is situated on fallow agricultural land, with no land in the vicinity of the project site that is zoned as forest land, timberland, or timberland production. Therefore, there would be no impacts regarding the rezoning of forest land, timberland, or timberland zoned for timberland production. The site is not enrolled in a Williamson Act contract and not mapped by Farmland Mapping & Monitoring Program (FMMP) as Urban and Built-Up Land or Water. These topics will not be addressed further in the EIR.

3. AIR QUALITY Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?		x		
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?		x		
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?		x		
d) Expose sensitive receptors to substantial pollutant concentrations?		x		
e) Create objectionable odors affecting a substantial number of people?			x	

Discussion:

a–d - Pursuant to the 1990 Federal Clean Air Act Amendments (FCAAA), the U.S. Environmental Protection Agency (EPA) classifies air basins (or portions thereof) as "attainment" or "nonattainment" for each criteria air pollutant, based on whether or not the National Ambient Air Quality Standards (NAAQS) have been achieved. In addition, under the California Clean Air Act (CCAA), areas have been designated as attainment or nonattainment with respect to the California Ambient Air Quality Standards (CAAQS). The San Joaquin Valley is designated nonattainment for federal and state 8-hour ozone and PM2.5 standards, as well as nonattainment for the state 1-hour ozone and PM10 standards. Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving volatile organic compounds (VOCs, also called reactive organic gases (ROG), such as xylene, and nitrogen oxides (NOx), such as nitric oxide. Major sources of ozone precursors include fuel combustion and solvent evaporation. Particulate matter in the atmosphere results from many kinds of aerosol-producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of particulate matter, such as demolition and construction activities, are more local in nature, while others, such as vehicular traffic, have a more regional effect.

The San Joaquin Valley Air Pollution Control District (SJVAPCD) is the regional government agency charged with regulating sources of air pollution in eight counties in California's Central Valley (San Joaquin, Stanislaus, Merced, Kern, Fresno, Kings, Tulare and the valley portion of Kern County) to maintain clean air and protect the health of the public and the environment. SJVAPCD is also the primary agency preparing the regional air quality plans mandated under state and federal law. Construction and operation of The Grapevine Project would result in development of a new shopping center with retail, restaurants,

delivery and parking facilities, as well as traffic improvements. Increased air emissions would result from the construction and operation of these facilities, resulting in potentially significant effects.

Potential project impacts to air quality include dust and other construction-related emissions and emissions from chemicals used in daily operations. Construction emissions relate primarily to heavy equipment use and fugitive dust, while operational emissions include both stationary and mobile (motor vehicle) sources. Impacts to air quality are potentially significant and will be addressed in the EIR.

The project's air quality impacts will be examined by impact modeling and will address the potentially significant impacts on localized and regional air quality. Primary air quality issues associated with the proposed project would be impacts to air quality from long-term indirect mobile sources (i.e., traffic generation) and the potential emission of dust during grading activities and diesel exhaust from equipment during construction activities at the project site. The potential for cumulatively significant impacts will also be addressed.

The analysis of air quality impacts will likely be based on current SJVAPCD guidance for a Full Analysis Level (FAL), which is the level of analysis usually required for an EIR. An FAL requires an air quality report that fully describes the air quality impacts to the public, and includes:

- Estimation of mobile and area source emissions
- Screening of project for CO impacts
- Preparation of an air quality report containing existing air quality conditions, analysis of potential air quality impacts, modeling, and mitigation measure.

Potential air quality impacts discovered during a FAL evaluation would be compared with existing applicable SJVAPCD significance thresholds for determination of significance. The findings of this analysis will be used to provide feasible and effective mitigation measures for impacts resulting from project construction and operation.

e - The project has the potential to create odors in the project area due to the use of chemicals with distinct aromas (including asphalt). However, these odors are not anticipated to be long-term or objectionable, nor are they anticipated to affect a substantial number of people. Potential impacts associated with odors are considered to be less than significant, however, and will not be further discussed in the EIR.

4. BIOLOGICAL RESOURCES Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) 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 or U.S. Fish and Wildlife Service?	x			
b) Have a substantial adverse effect on any riparian, aquatic or wetland habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or US Fish and Wildlife Service?	x			
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?				x
d) 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?	x			
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	x			
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	x			

Discussion:

a, b – Construction of the proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements. Development is planned to occur within Delano's city limits; however, the property is located on and adjacent to lands that are currently or historically undeveloped or agricultural in nature.

A biological evaluation of the project site will be conducted. The reconnaissance survey and resulting report will describe the existing site conditions, provide a list of special status plant and animal species potentially present (based on the California Department of Fish and Wildlife's Natural Diversity Data Base, the Federal Critical Habitat Mapper, National Wetland Inventory, and other resources), and identify common and any special status species surveyed at the site. The assessment will identify any direct or indirect potentially significant resource impacts (on species or habitats) and provide appropriate mitigation measures. Pursuant to the City General Plan, properties which may have listed plant and animal species will be required to have biological investigation if such species may be

present. Federal and State protocols and requirements shall be used for such surveys and needed mitigation (City of Delano, 2005; page 4-19).

c – There is no known wetland or riparian habitat on the project site or immediate area; therefore, impacts to wetland resources would not be impacts. This issue will not be addressed in the EIR.

d – Due to the proximity of the project to open areas with the potential for native wildlife corridors and native wildlife nursery sites, impacts to those biological resources are considered potentially significant and will also be addressed in the EIR.

e, f – The City of Delano does not have a specific Habitat Conservation Plan, Natural Community Conservation Plan, or ordinances protecting native biological resources. The City supports adherence to federal and state regulations and their mitigation for adverse impacts, including cumulative impacts to biological resources. Potential conflict with regional and other plans and policies is a potentially significant impact and will be addressed in the EIR.

5. CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	X			
b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?	X			

Discussion:

a – The proposed project will result in construction of approximately 328,500 square feet of shopping center development. Increased energy usage would result from both stationary sources (i.e., energy for heating, cooling and other mechanical equipment) and mobile sources (i.e., vehicle fuel consumption). It is not anticipated that this increase in energy consumption would be wasteful or unnecessary; however, an analysis of expected energy use and its impacts on air emissions will be addressed in the EIR. The EIR will also evaluate the proposed project's cumulative impact on Green House Gas emissions ("GHG"). The indirect effects of energy consumption, including air quality emissions, will also be examined separately in the EIR (see Air Quality, Impact 3, above).

b – The proposed project includes future construction of new buildings, roads and associated utilities, which could contribute to additional mobile sources of GHG during construction and additional stationary sources of greenhouse gas emissions during operation. Additionally, a potential increase in traffic due to the development could contribute to an increase in mobile sources (vehicle miles traveled [VMT]) of greenhouse gas emissions once the shopping center is constructed. Therefore, the potential for the project to conflict with applicable plans, policies or regulations related to reducing GHG emissions is considered potentially significant and will be addressed in the EIR.

6. CULTURAL RESOURCES Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in '15064.5?	x			
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to '15064.5?	x			
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?		x		
d) Disturb any human remains, including those interred outside of formal cemeteries?	x			

Discussion:

a, b, c - Planned construction of the proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements. These facilities would be located within the Delano city limits, in an area that has been historically used for agriculture, which is now fallow land with no structures.

Due to the approximately 45-acre size of the shopping center project area and likely amount of earth disturbance during construction, it is possible that undiscovered archaeological or paleontological resources could be found within the project area. Indigenous cultures once occupied various sites within Kern County. Additionally, a number of paleontological discoveries have occurred within some areas of Kern County. Earthmoving activities associated with the construction of the project elements may result in a significant impact to previously unidentified unique resources. These impacts are potentially significant and will be addressed in the EIR.

The cultural resources section of the EIR will include a records search at the Southern San Joaquin Valley Information Center at California State University, Bakersfield; a sacred lands search conducted by the Native American Heritage Commission; consultation, as appropriate, with Native Americans and other interested parties (e.g., local historical societies); research to provide a prehistoric and historic context for the project area; and a pedestrian surface survey. To address the potential for paleontological resources, geotechnical borings currently underway for the project site will be reviewed to determine the type and depth of soil and geologic formations. These data will be used to determine the overall likelihood of the presence of unique paleontological resources, the potential for disturbance of these resources, and if needed, the appropriate mitigation measures to protect unique resources.

d – Human remains, including those interred outside of formal cemeteries, can be disturbed during excavation and earthmoving activities such as that anticipated for the proposed Project. Although also not considered likely, this impact is potentially significant and will be addressed in the EIR.

7. GEOLOGY AND SOILS Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	×			
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	×			
ii) Strong seismic ground shaking?	×			
iii) Seismic-related ground failure, including liquefaction?	×			
iv) Landslides?				×
b) Result in substantial soil erosion or the loss of topsoil?	×			
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	×			
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	×			
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?				×

Discussion:

The geology and soils section of the EIR will address the suitability of the site for commercial uses based on the soils and geotechnical investigation. Development of the project site would involve grading activities, which may result in increased rates of soil erosion and subsequent sedimentation to nearby drainage areas. For the geology and soils analysis, soil conditions at the project site will be described and any information regarding geologic or seismic hazards will be identified. Mitigation measures will be proposed for any significant impacts associated with geology, soils, and seismic hazards. Such measures typically address design-level construction criteria, depending upon the conditions present.

a.i - According to the Delano General Plan (City of Delano Planning, 2005), the City of Delano is located in a geologically stable area of California that contains no Alquist-Priolo Earthquake Fault Zones. There is, however, an identified fault located approximately three miles away, and therefore this seismic impact is potentially significant and will be addressed in the EIR.

a.ii-iii - Delano, located in the southern San Joaquin Valley, is on a deep alluvial basin and may be affected by strong seismic events in or near the east and west ends of Kern County. This seismic impact is potentially significant and will be addressed in the EIR.

a.iv – Delano and the project site are located in an area that has a predominately flat topography, with no potential of landslide on or off of the site. This topic will not be addressed further in the EIR.

b – Construction activities will include removal of vegetation, excavation and removal of soil from construction sites, and grading activities. These activities have the potential to result in soil erosion and loss of topsoil. This impact is potentially significant and will be addressed in the EIR.

c – As noted in *a.ii-a.iv*, the project has some potential to result in hazards associated with spreading, etc. Because construction of the proposed project would involve excavation and earth-moving activities during construction, this impact is potentially significant and will be addressed in the EIR.

d – In the local area there may be some areas of expansive clay soil that may require special construction standards for foundations and infrastructure. This impact is potentially significant and, as applicable to implementation of the proposed project, will be addressed in the EIR.

e – The proposed project will not include septic tanks or alternative wastewater disposal systems. Therefore, there would be no impact. This topic will not be addressed further in the EIR.

8. HAZARDS AND HAZARDOUS MATERIALS Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	x			
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	x			
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				x
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				x
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, would the project result in a safety hazard for people residing or working in the project area?	x			
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				x
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	x			
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?				x

Discussion:

Planned construction of the Project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements. These facilities would be located within the Delano city limits, in an area that has been historically used for agriculture; however, now the land is fallow land with no structures. A search of the California State Department of Toxic Substances Control (DTSC) database (http://www.envirostor.dtsc.ca.gov/) indicates no known or historic hazardous substances sites located at the proposed project site. There are no schools in the vicinity of the site and it is not in a forested area with potential wildfire hazards threats; however, it is located within two miles of an area governed by an airport land use plan.

An analysis of hazardous materials will evaluate the potential for the project to create a significant hazard through the use, transport, or storage of hazardous materials, as, well as possible impacts related to the nearby Delano Municipal Airport and impacts regarding emergency response plans. This section will utilize standard historic records including

maps, photos and City directory obtained from commercial environmental database to evaluate past uses of hazardous materials.

a, b – Planned construction of the proposed project would involve use of substances that may be considered hazardous. Additionally, small quantities of hazardous materials may be used during the operation and maintenance of shopping centers. Spills or accidents during construction and operation would also represent a potential hazard to the public and environment. This impact is potentially significant and will be addressed in the EIR.

c – The proposed project is not within a quarter mile of a school and is unlikely to emit significant hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste; therefore, these impacts will not be evaluated in the EIR.

d – Numerous Leaking Underground Storage Tank (LUST) sites are located within the City of Delano and surrounding area (EnviroStor, 2013). The site is not identified on this list, and therefore these impacts will not be evaluated in the EIR.

e, f – The proposed project is located within two miles of the Delano Municipal Airport, but not in the vicinity of a private airstrip. Specifically, the project site may be located within the planning area of the airport. These impacts are potentially significant and will be addressed in the EIR.

g – Construction of project elements, especially utility pipelines and roads, may interfere temporarily with traffic flow and roadway use. This could also potentially interfere with emergency vehicle access and evacuation routes. This impact is potentially significant and will be addressed in the EIR.

h – The proposed project site is located within the Delano city limits. The site borders developed and undeveloped lots and these areas are not considered wildlands; therefore, these impacts will not be evaluated in the EIR.

9. HYDROLOGY AND WATER QUALITY Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Violate any water quality standards, conflict with water quality objectives, fail to meet waste discharge requirements, significantly degrade any surface water body or groundwater, or adversely affect the beneficial uses of such waters, including public uses and aquatic, wetland and riparian habitat?	x			
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	x			
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site (i.e.,. within a watershed)?	x			
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff (e.g., due to increased impervious surfaces) in a manner which would result in flooding on- or off-site (i.e. within a watershed)?	x			
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems due to changes in runoff flow rates or volumes?	x			
f) Result in a significant increase in pollutant discharges to receiving waters (marine, fresh, and/or wetlands) during or following construction (considering water quality parameters such as temperature, dissolved oxygen, turbidity, and typical stormwater pollutants such as heavy metals, pathogens, petroleum derivatives, synthetic organics, sediment, nutrients, oxygen-demanding substances, and trash)?	x			
g) Result in an increase in any pollutant for which a water body is listed as impaired under Section 303(d) of the Clean Water Act?				x
h) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				x
i) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	x			
j) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	x			

9. HYDROLOGY AND WATER QUALITY Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
k) Inundation by seiche, tsunami, or mudflow?				×

Discussion:

The proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements.

a–e – Potential hydrology and drainage impacts associated with the proposed project, including the potential to degrade surface water or groundwater, will be addressed in this section. The discussion of surface water hydrology will describe existing on-site drainage conditions and evaluate the potential impacts of increased impervious surfaces and resulting from increased peak runoff from the project's downstream storm and drainage facilities. The on-site storm drainage system planned for the proposed project will be reviewed, described, and evaluated in terms of its ability to mitigate potential on-site and off-site drainage and flooding impacts based on the drainage plan and runoff calculations conducted for the proposed project.

f – The discussion of water quality will address potential impacts resulting from the project, during both construction and operation. Specific mitigation measures to control erosion during construction will be identified, as will measures planned to be incorporated into project design to control urban non-point source pollution. Grading activities exceed one acre; therefore, this section of the EIR will discuss the requirement to comply with the General Permit on stormwater management, pursuant to the NPDES implementation program administered by the State and Regional Water Quality Control Boards. These impacts are considered potentially significant and they will be addressed in the EIR.

g – There are no surface water bodies at or near the project site, no defined channels to transport materials to these channels or water bodies. There are consequently no 303(d) listed water bodies to impact, therefore, there would be no impact. This topic will not be addressed further in the EIR.

h – There are no residences proposed for this project; therefore, there would be no impact. This topic will not be addressed further in the EIR.

i-j – Construction of the proposed project would include placement of non-residential structures in identified flood hazard areas. These potentially significant impacts will be addressed in the EIR.

k – Due to the proposed project's inland location and level topography, it is not anticipated that its construction would result in exposing people or structures to inundation by seiche, tsunami, or mudflows. Therefore these impacts will not be evaluated in the EIR.

10. LAND USE AND PLANNING Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Physically divide an established community.				x
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	x			
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	x			

Discussion:

a – The proposed project is located at the southwest border of the City of Delano, California. The project site, annexed to the City in 2004, was formerly used for agricultural purposes and is not located in or between an established community. There is no potential for the proposed project to physically divide an established community. This impact will not be discussed further in the EIR.

b – This section of the EIR will evaluate the compatibility of the proposed project with the existing and planned uses in the vicinity of the project site. Included within this section will be an evaluation of the consistency of the proposed project with the City of Delano General Plan and Zoning Ordinance, as well as any other applicable city plan, policy or regulation. The City of Delano General Plan (Delano, 2005; page 6-5) presents community development policies to "Ensure that all commercial development is attractive and of high-quality design, to enhance the image of the City." The General Plan also provides design standards to encourage sound site planning and design for both on and off-site features. An assessment of the proposed project's conformance with the City policies and design standards will be provided in the EIR land use section.

The Grapevine Project site has a land use designation of "Commercial" in the City of Delano General Plan (City of Delano 2005). The project site is currently zoned a combination of "CRC" (Community Retail Commercial) and "GC" (General Commercial). A primary purpose of the "CRC" district is to provide suitable locations for commercial uses requiring large parcels and the primary purpose of the "GC" district is to provide sites for commercial uses that will serve a large segment of the population with a wide variety of retail, wholesale, service and office uses. The City of Delano has designated this location for commercial use in the *City of Delano General Plan* (City of Delano 2005); therefore, the proposed project is not anticipated to conflict with zoning for agricultural use. However, the compatibility of the proposed project with the existing and planned uses in the vicinity of the project site has the potential to result in significant impacts and will be addressed in the project EIR.

c – As discussed in this document under Biological Resources (*Impact 4e and 4f*), the 2005 Delano General Plan identifies the need to perform special wildlife and plant studies as needed to protect those resources. However, at this time it does not appear that there are any Habitat Conservation Plans or Natural Community Plans in effect for the site. Potential conflict with local plans and policies is a potentially significant impact and will be addressed fully in the EIR.

11. MINERAL RESOURCES Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?				X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?				X

Discussion:

a, b – The proposed project is located in a rural area with historic use as agriculture land. According to the City of Delano General Plan, there are no significant mineral resources or mining operations in Delano or its Sphere of Influence (Delano, 2005; page 4-4). Therefore, the project would not impact important mineral resource, nor would it construct facilities over this resource area, preventing future resource excavation. This impact is less than significant and will not be addressed further in the EIR.

12. NOISE Would the project result in:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?		x		
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	x			
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?		x		
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?		x		
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, would the project expose people residing or working in the project area to excessive noise levels?	x			
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?				x

Discussion:

The proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements.

a, c, d –These facilities will be located within a commercially designated area. However some facilities, such as loading docks, may be located near residential areas located to the north of the project site. Increased temporary noise associated with construction and long-term noise associated with operation of the shopping center could result in potentially significant effects. Construction impacts would relate primarily to heavy equipment use, while operational noise would include both stationary (e.g., mechanical equipment) and mobile (vehicle) sources and may cause ambient noise levels that conflict with noise exposure guidelines included in the Delano General Plan Noise Element (City of Delano, 2005). Noise impacts are potentially significant and will be addressed in the EIR.

The noise analysis will identify noise from traffic generation along roadways where residential or other potential noise-sensitive receptors are located. Future noise levels generated by the construction and operation of the proposed project will be projected to the nearest noise-sensitive receivers and placed into context within the future noise environment. Short-term construction noise impacts will be assessed by estimating construction-related noise and projecting the noise levels to the nearest noise sensitive receptors. The incremental increase in noise from project-generated traffic will be assessed. On-site noise sources (e.g., loading docks) and the effect on adjacent sensitive receptors will also be addressed. This section will identify feasible mitigation measures to

reduce any significant noise impacts and potential changes to the project, if warranted, to reduce significant noise impacts to less than significant levels.

b – Groundborne vibration could be generated by project-related construction activities such as soil compaction for structures. Although this is typically expected from pile driving or explosives use, some heavy equipment operated in close proximity to existing buildings can also result in groundborne vibration. This impact is potentially significant and will be addressed in the EIR.

e, f – Project construction would be located within the planning area of a public airport, but not a private airport. Specifically, project structures including signs would be located within two miles of the Delano Municipal Airport with its associated airport land use planning areas. These impacts are potentially significant and will be addressed in the EIR.

13. POPULATION AND HOUSING Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	x			
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?				x
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				x

Discussion:

a - No new residential development is included in the proposed project; however, implementation of the proposed project could affect population and housing if the addition of over 600 new jobs at the shopping center. The EIR will provide a complete evaluation of the growth-inducement potential of the proposed project as compared to the planned growth in the study area and will address any potential growth-related impacts relating to the proposed project.

b, c – The proposed project site is vacant and the proposed project would not displace any existing housing nor displace substantial numbers of people. No environmental impacts associated with housing displacement are expected to occur, and no further analysis in the EIR is warranted.

14. PUBLIC SERVICES Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the following public services:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Fire protection?	x			
b) Police protection?	x			
c) Schools?				x
d) Parks?				x
e) Other public facilities?				x

Discussion:

No new or expanded fire protection, police protection, school, and park facilities are included as elements of the proposed project. Moreover, construction of the proposed project is not anticipated to directly affect fire or police buildings, schools, park or other City properties. However, operation of the proposed shopping center project will require fire protection and police protection services. This section of the EIR will address the issues of fire and police protection and other public services. The City of Delano Police Department will be contacted regarding adequacy of response times to the project site and a determination if the proposed project would result in the need for additional personnel or equipment. However, consistent with CEQA requirements, significant environmental impacts are not anticipated to occur unless the project will trigger the construction of new or expanded services, such as a new fire station, which in turn would have additional environmental consequences.

a – Fire protection services in the project area are provided by the Kern County Fire Department. Each of the shopping center structures as well as individual uses such as restaurants and the theatre will result in a need for periodic fire inspections. Also, the project site may require emergency services. Therefore, project impacts on fire protection services are potentially significant and will be evaluated in the EIR.

b – Police protection services in the project area are provided by the City of Delano Police Department. The proposed project may result in an increased demand for police services. Accordingly, the proposed project impacts on police services are potentially significant and will be evaluated in the EIR.

c – The proposed project does not involve construction of residential land uses that would generate new residents. Therefore, the proposed project would not result in the need for new school services. Further analysis of this issue is not warranted in the EIR.

d – Given the proposed project type and absence of new residential units, the proposed project would not result in additional demand for park facilities. Further analysis of this issue is not warranted in the EIR.

e – Given the proposed project and the lack of any other associated public facilities, there will be no project impact. Further analysis of this issue is not warranted in the EIR.

15. RECREATION Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				x
b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				x

Discussion:

a-b – Parks and open space are not components of the proposed project; however, the shopping center would be open to the public and provide some recreational facilities including a 12-screen movie theater. The proposed project does not include residential housing and, as a result, there would not be a detectable increase in the use of existing parks or recreational facilities. No environmental impacts associated with recreation are expected to occur, and no further analysis is warranted in the EIR.

16. TRANSPORTATION AND TRAFFIC Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	×			
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	×			
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	×			
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	×			
e) Result in inadequate emergency access?	×			
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	×			

Discussion:

a–f – Construction and operation of the proposed project would result in development of a new shopping center with retail, restaurants, delivery and parking facilities, as well as traffic improvements to accommodate increased traffic. The shopping center structures will be located within the Delano city limits; however, some traffic may affect nearby unincorporated areas currently in agricultural and rural residential uses.

The proposed project will be served via the four streets that define the project boundary: Woollomes Avenue to the south, Dover Parkway to the east, Morse Boulevard to the north, and Albany Street (Stradley Avenue) to the west. Various levels of street improvements will be made to facilitate traffic circulation for this development. The proposed project includes approximately 2,512 parking spaces and would provide approximately 617 full-time-equivalent jobs.

During construction, worker commute vehicles would account for the majority of traffic trips to the project site. Delivery of material and supplies would reach the project site through on-road truck delivery via local roadways. Construction traffic could interfere with non-construction vehicular movement and level of service (LOS), transit and alternative transportation routes, temporary incompatible land uses, availability of parking,

emergency access, and may require temporary roadway lane closures.

Likewise, after construction, customer, employee, and delivery traffic trips to and from the shopping center could affect vehicular movement and LOS, transit and alternative transportation routes, temporary incompatible land uses, availability of parking, and possibly emergency access. These trips may decrease the existing LOS on area freeway interchanges, roadways, and intersections.

Both construction and operational traffic impacts are considered to be potentially significant and will be addressed in the EIR. A traffic analysis will be prepared, and potential impacts on the local roadway system from construction-related vehicle trips as well as long-term operations will be evaluated in the EIR. It is assumed that the project's impacts (as well as its cumulative impacts) will be clearly identified. The EIR will also identify the proposed project’s incremental contribution to cumulative traffic impacts, and any required mitigation.

17. UTILITIES AND SERVICE SYSTEMS Would the project:	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?				x
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	x			
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	x			
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	x			
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	x			
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?			x	
g) Comply with federal, state, and local statutes and regulations related to solid waste?	x			

Discussion:

Implementation of the proposed project would result in extension of City's water distribution lines, sanitary sewer facilities, and other utility infrastructure and service systems to support the new shopping center. The proposed project will connect to the existing sanitary sewer and domestic water mains in the vicinity of the project site. The project will also require solid waste disposal and recycling services. Project utilities and service systems located within the Delano city limits will be evaluated in the relevant technical sections and impact discussions of the EIR.

The Utilities and Service Systems assessment will quantify demands for water, sewer and utility service systems based upon the proposed project description. The analysis will discuss the ability of existing or planned systems to accommodate the project and identify potential environmental impacts that could result from the need for new or expanded systems.

a – Sanitary sewer service to the project site is to be provided through an existing 18-inch sewer line running along Woollomes Avenue. Wastewater improvements will be constructed in accordance with Delano City standards. Potential impacts are expected to be less than significant, and no further analysis is warranted.

b – The project site would be provided potable water service though an existing 12-inch water line, which runs along Woollomes Avenue; additional water service infrastructure improvements will be constructed on-site. All water lines will be constructed in accordance with standards of the City of Delano. Drinking water requirements of the Kern County Health Department and California Department of Public Health will be followed. Potential impacts related to surface and groundwater supplies will be addressed in an EIR section discussion of hydrology and water quality. Potential impacts are expected to be less than significant, but will be further analyzed in the EIR.

c – Storm drainage from the proposed project will be directed to an existing 72-inch line, which empties into an existing unlined storm water retention basin with a capacity of approximately 100 acre-feet owned by the City of Delano, located west of Stradley Avenue. Potential environmental impacts associated with storm drainage facilities will be addressed in an EIR section for local hydrology, drainage, and groundwater. Potential impacts are expected to be less than significant, but will be further analyzed in the EIR.

d – The extent of existing entitlements is not clear and requires review**.** Potential impacts are expected to be less than significant, but will be further analyzed in the EIR.

e – The extent of existing waste water treatment capacity is not clear and requires review**.** Potential impacts are expected to be less than significant, but will be further analyzed in the EIR.

f – The City of Delano utilizes the Shafter-Wasco Recycling and Sanitary Landfill located approximately twenty miles southwest of Delano. In 2010, this County-owned and operated facility was expanded from 160 acres to 357 acres. As indicated by the approved permit for the landfill, project-generated solid waste as well as other City of Delano solid waste will be accommodated through its estimated closure year of 2053, extended from 2027 (Kern County, 2010, page 1).

Materials brought to the project sites would be used to construct facilities, and few residual materials are expected. Non-hazardous construction refuse and solid waste would be either collected and recycled, or disposed of at a local landfill, while any hazardous waste generated during construction would be disposed of at an approved location. It is not anticipated that the amount of solid waste generated by the proposed project would exceed the capacity of local landfills needed to accommodate the waste; therefore, this issue will not be further analyzed in the EIR.

g – The proposed project would generate solid waste during construction and operation, thus requiring the consideration of waste reduction and recycling measures. The 1989 California Integrated Waste Management Act (AB 939) requires Kern County to attain specific waste diversion goals. In addition, the California Solid Waste Reuse and Recycling Access Act of 1991, as amended, requires expanded or new development projects to incorporate storage areas for recycling bins into the proposed project design. The project would comply with the 1989 California Integrated Waste Management Act and the 1991 California Solid Waste Reuse and Recycling Access Act of 1991, as amended. Therefore, impacts are anticipated to be less than significant; however further analysis of this issue is warranted in the EIR.

18. MANDATORY FINDINGS OF SIGNIFICANCE	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	X			
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	X			
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	X			

Discussion:

a – Construction of the proposed project would result in development of a new shopping center with retail stores, restaurants, a 12-screen theatre, parking and supporting facilities, such as loading areas for commercial uses. Construction and operational activities have the potential to impact specific plants, animals and their habitat. As discussed above under biological resources (see discussion of impact 4), these impacts will be addressed in the EIR.

b – Construction and operational activities associated with the proposed project could result in impacts which are "cumulatively considerable" when added to impacts of other past, present, and reasonably foreseeable future projects. The proposed project has the potential to contribute to cumulative aesthetic, air quality, biological resource, cultural resource, geology, greenhouse gas emissions, hydrology, land use, noise, public service, and traffic/transportation impacts. The EIR will evaluate the project's contribution to cumulative impacts in these and other resource areas.

c – Construction and operational activities associated with the proposed project have the potential to result in adverse effects to human beings, including impacts related to air emissions, noise, and exposure to hazardous materials. Potential direct and indirect project impacts will be examined in the EIR for each environmental topic.

SECTION 4. REFERENCES

CEQA, 2012. California, State of, California Environmental Quality Act (CEQA), as amended to present, 2012.

CDMG, 1997. California Division of Mines and Geology, DMG Special Publication 42: *Fault-Rupture Hazard Zones in California*, revised 1997.

Caltrans, 2013. California Department of Transportation. Scenic Highway Program website accessed on February 11, 2013.
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California, 2013. California, State of, Public Resources Code, as amended to present, 2012.

City of Delano, 2005. City of Delano General Plan, adopted December 2005. Plan accessed on line February 12, 2013 http://www.cityofdelano.org/index.aspx?NID=113

DTSC, 2013. California Department of Toxic Substance Control (DTSC), EnviroStor database, accessed on line February 11, 2013.

Kern County, 2010. Kern County Environmental Health Services Department Solid Waste Local Enforcement Agency, Solid Waste Facility Permit for the Shafter-Wasco Sanitary Landfill. Issued February 24, 2010.

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

April 11, 2013

Richelle Carino
City of Delano
Community Development Department
PO Box 3010
1005 11th Avenue
Delano, CA 93215

RECEIVED
APR 17 2013
By MP

Project: NOP/IS – The Grapevine Project
District CEQA Reference No: 20130309

Dear Ms. Carino:

The San Joaquin Valley Unified Air Pollution Control District (District) has reviewed the Notice of Preparation (NOP) for the Grapevine project. The proposed project consists of 328,500 square foot shopping center. The District offers the following comments:

Emissions Analysis

1) The District is currently designated as extreme nonattainment for the 8-hour ozone standard, attainment for PM10 and CO, and nonattainment for PM2.5 for the federal air quality standards. At the state level, the District is designated as nonattainment for the 8-hour ozone, PM10, and PM2.5 air quality standards. The District recommends that the Air Quality section of the Environmental Impact Report (EIR) include a discussion of the following impacts:

   a) **Criteria Pollutants:** Project related criteria pollutant emissions should be identified and quantified. The discussion should include existing and post-project emissions.

      i) Construction Emissions: Construction emissions are short-term emissions and should be evaluated separate from operational emissions. The District recommends preparation of an Environmental Impact Report (EIR) if annual construction emissions cannot be reduced or mitigated to below the following levels of significance: 10 tons per year of oxides of nitrogen (NOx), 10 tons

Seyed Sadredin
Executive Director/Air Pollution Control Officer

Northern Region
4800 Enterprise Way
Modesto, CA 95356-8718
Tel: (209) 557-6400 FAX: (209) 557-6475

Central Region (Main Office)
1990 E. Gettysburg Avenue
Fresno, CA 93726-0244
Tel: (559) 230-6000 FAX: (559) 230-6061

Southern Region
34946 Flyover Court
Bakersfield, CA 93308-9725
Tel: 661-392-5500 FAX: 661-392-5585

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per year of reactive organic gases (ROG), or 15 tons per year particulate matter of 10 microns or less in size (PM10).

- *Recommended Mitigation:* To reduce impacts from construction related exhaust emissions, the District recommends feasible mitigation for the project to utilize off-road construction fleets that can achieve fleet average emissions equal to or cleaner than the Tier II emission standards, as set forth in §2423 of Title 13 of the California Code of Regulations, and Part 89 of Title 40 Code of Federal Regulations. This can be achieved through any combination of uncontrolled engines and engines complying with Tier II and above engine standards.

ii) Operational Emissions: Permitted (stationary sources) and non-permitted (mobile sources) sources should be analyzed separately. The District recommends preparation of an Environmental Impact Report (EIR) if the sum of annual permitted and non-permitted emissions cannot be reduced or mitigated to below the following levels of significance: 10 tons per year of oxides of nitrogen (NOx), 10 tons per year of reactive organic gases (ROG), or 15 tons per year particulate matter of 10 microns or less in size (PM10).

iii) Recommended Model: Project related criteria pollutant emissions should be identified and quantified. Emissions analysis should be performed using CalEEMod (**Cal**ifornia **E**mission **E**stimator **Mod**el), which uses the most recent approved version of relevant Air Resources Board (ARB) emissions models and emission factors. CalEEMod is available to the public and can be downloaded from the CalEEMod website at: www.caleemod.com.

b) **Nuisance Odors:** The project should be evaluated to determine the likelihood that the project would result in nuisance odors. Nuisance orders are subjective, thus the District has not established thresholds of significance for nuisance odors. Nuisance odors may be assessed qualitatively taking into consideration of project design elements and proximity to off-site receptors that potentially would be exposed objectionable odors.

c) **Health Impacts:** Project related health impacts should be evaluated to determine if emissions of toxic air contaminants (TAC) will pose a significant health risk to nearby sensitive receptors. TACs are defined as air pollutants that which may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health. The most common source of TACs can be

d) attributed to diesel exhaust fumes that are emitted from both stationary and mobile sources. Health impacts may require a detailed health risk assessment (HRA).

Prior to conducting an HRA, an applicant may perform a prioritization on all sources of emissions to determine if it is necessary to conduct an HRA. A prioritization is a screening tool used to identify projects that may have significant

health impacts. If the project has a prioritization score of 1.0 or more, the project has the potential to exceed the District's significance threshold for health impacts of 10 in a million and an HRA should be performed.

If an HRA is to be performed, it is recommended that the project proponent contact the District to review the proposed modeling approach. The project would be considered to have a significant health risk if the HRA demonstrates that project related health impacts would exceed the District's significance threshold of 10 in a million.

More information on TACs, prioritizations and HRAs can be obtained by:

- E-mailing inquiries to: hramodeler@valleyair.org; or
- Visiting the District's website at:

  http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm.

2) In addition to the discussions on potential impacts identified above, the District recommends the EIR also include the following discussions:

   a) A discussion of the methodology, model assumptions, inputs and results used in characterizing the project's impact on air quality. To comply with CEQA requirements for full disclosure, the District recommends that the modeling outputs be provided as appendices to the EIR. The District further recommends that the District be provided with an electronic copy of all input and output files for all modeling.

   b) A discussion of the components and phases of the project and the associated emission projections, including ongoing emissions from each previous phase.

   c) A discussion of project design elements and mitigation measures, including characterization of the effectiveness of each mitigation measure incorporated into the project.

   d) A discussion of whether the project would result in a cumulatively considerable net increase of any criteria pollutant or precursor for which the San Joaquin Valley Air Basin is in non-attainment. More information on the District's attainment status can be found online by visiting the District's website at:

   http://valleyair.org/aqinfo/attainment.htm

District Rules and Regulations

3) The proposed project may be subject to District rules and regulations, including: Regulation VIII (Fugitive PM10 Prohibitions), Rule 4102 (Nuisance), and Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations). In the event an existing building will be renovated, partially demolished or removed,

the project may be subject to District Rule 4002 (National Emission Standards for Hazardous Air Pollutants).

4) Based on information provided, the proposed project would equal or exceed the relevant District Rule 9510 (Indirect Source Review) applicability threshold of 50 residential units, 2,000 square feet of commercial space. Therefore, the District concludes that the proposed project is subject to District Rule 9510.

   Any applicant subject to District Rule 9510 is required to submit an Air Impact Assessment (AIA) application to the District no later than applying for final discretionary approval, and to pay any applicable off-site mitigation fees before issuance of the first building permit. If approval of the subject project constitutes the last discretionary approval by your agency, the District recommends that demonstration of compliance with District Rule 9510, including payment of all applicable fees before issuance of the first building permit, be made a condition of project approval. Information about how to comply with District Rule 9510 can be found online at:

   http://www.valleyair.org/ISR/ISRHome.htm.

5) The above list of rules is neither exhaustive nor exclusive. To identify other District rules or regulations that apply to this project or to obtain information about District permit requirements, the applicant is strongly encouraged to contact the District's Small Business Assistance (SBA) Office at (661) 392-5665. Current District rules can be found online at the District's website at:

   www.valleyair.org/rules/1ruleslist.htm.

The District recommends that a copy of the District's comments be provided to the project proponent. If you have any questions or require further information, please call David McDonough at (559) 230-5920.

Sincerely,

David Warner
Director of Permit Services

For, Arnaud Marjollet
Permit Services Manager
DW:dm

cc: File

KERN COUNTY WASTE MANAGEMENT DEPARTMENT

Douglas E. Landon, Director
2700 "M" Street, Suite 500
Bakersfield, CA 93301-2372
(661) 862-8900
(800) 552-KERN (option 6)
Fax: (661) 862-8905
http://www.kerncountywaste.com

April 26, 2013

Richelle Carino, Director
Community Development Department
City of Delano
1015 Eleventh Avenue
Delano, CA 93215

RE: City of Delano's Notice of Preparation of a Draft Environmental Impact Report, The Grapevine Project

Dear Ms. Carino:

Thank you for the opportunity to comment on the City of Delano's Notice of Preparation (NOP) of a Draft Environmental Impact Report for The Grapevine Project. The project site is approximately 44.64 acres, identified as Assessor's Parcel Number 521-010-21, and located on Woollomes Avenue near State Route 99. The project consists of construction and operation of an approximately 328,500 square-foot shopping center to include a 12-screen theater, retail shops, and restaurants (sit-down and fast-food).

The Kern County Waste Management Department (KCWMD) has reviewed the NOP for The Grapevine Project and has the following comments:

Solid Waste Landfill

Solid waste generated by this project will likely be disposed of in the Shafter-Wasco Recycling and Sanitary Landfill (RSLF), located at 16721 Scofield Avenue, Shafter, CA, 93263. This Shafter-Wasco RSLF has a:

- permitted maximum tonnage of 1,500 tons per day;
- permitted traffic volume of 788 vehicles per day;
- permitted capacity of 21,895,179 yd^3; and
- an estimated capacity date of October 2056.

Solid Waste Generation

In Section 3.17(f) of the NOP, Utilities and Service Systems, the statement is made that "*[i]t is not anticipated that the amount of solid waste generated by the proposed project would exceed the capacity of local landfills needed to accommodate the waste; therefore, this issue will not be further analyzed in the EIR.*"

KCWMD is unable to determine the impact this project may have on the solid waste infrastructure due to the lack of analysis provided in the NOP. In order to determine the amount of waste to be generated by the project, the KCWMD recommends completion of the attached Waste Generation Worksheet (WGWS) for both the construction and

ongoing business operations of the project. The WGWS will assist the project proponent in determining the general volume of solid waste resulting from the project. The information and data from the WGWS will assist the KCWMD in determining the impact the project may have on the solid waste infrastructure and recommending any mitigation measures that may be necessary.

The project site is located within the City of Delano, a Universal Collection Area. The City of Delano Public Works Department – Refuse and Solid Waste Division will provide solid waste service for the ongoing operations of the project.

During the construction phase, the project will generate construction and demolition (C&D) waste and inert debris (asphalt, brick, concrete, dirt, drywall, fencing, glass, metal, packing material, pallets, pipe, steel, and wood). The current gate fee for disposal of C&D waste at the Shafter-Wasco RSLF is $54.50 per ton.

The Shafter-Wasco RSLF operates diversion and recycling programs including source separated scrap metal, wood waste (lumber), and clean loads of inert materials (concrete). A discount may apply for source separated materials brought to the Shafter-Wasco RSLF. For discount conditions, contact the KCWMD Operations Division at (661) 862-8900. The project proponent is encouraged, to the greatest extent possible, to include provisions for recycling C&D waste and to utilize the diversion and recycling programs offered by the KCWMD and other local recyclers. The KCWMD recommends contacting the City of Delano's Public Works Department – Refuse and Solid Waste for additional regional recycling opportunities.

California Green Building Standards Code

The California Green Building Standards Code (Standards Code) will apply to construction related activities of this project. The purpose of the Standards Code is to improve public, health, safety, and general welfare by enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices. Provisions of the Standards Code shall apply to the design and construction of building structures subject to state regulation.

Per §708.3 – Construction Waste Reduction, Disposal, and Recycling of the Standards Code, a commercial entity is to *recycle and/or salvage for reuse a minimum of 50 percent of the non-hazardous construction and demolition debris, or meet a local construction and demolition waste management ordinance, whichever is more stringent.* The KCWMD recommends contacting the City of Delano's Public Works Department for specific local building code standards and regulations. In the absence of a local ordinance, the District is required to comply with the 50 percent recycling and/or salvaging element set forth in the Standards Code. The 2008 Standards Code can be located at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

Mandatory Commercial Recycling

Assembly Bill (AB) 341 declares that it is the policy goal of the state that not less than 75 percent of solid waste generated be source separated, reduced, recycled, or composted by the year 2020. AB 341 sets forth the requirements of the statewide mandatory commercial recycling program which defines that a business, including any commercial or public entity, generating four cubic yards or more of commercial solid waste per week are required to recycle. Businesses can take one or any combination of the following in order to reuse, recycle, or otherwise divert solid waste from disposal:

- Subscribe to a source separated recycling service with a regional franchise hauler authorized to provide service for the area in which the business is located;
- Subscribe to a mixed solid waste recycling service with a regional franchise hauler authorized to provide service for the area in which the business is located; or
- Self-recycle and certify compliance with Kern County Ordinance No. G-8337.

Ongoing business operations shall comply with AB 341. Additional information on AB 341 and mandatory commercial recycling information is available on KCWMD's website, http://www.kerncountywaste.com/ and the California Department of Resources Recycling and Recovery's website http://www.calrecycle.ca.gov/Climate/Recycling/.

KCWMD may provide additional comments for review and comment when a subsequent CEQA document is circulated for this project. If you have any further questions, please contact Katrina Slayton at (661) 862-8810 or myself at (661) 862-8918.

Sincerely,

Eric J. Greenwood, PE, PG, CHG
Engineering Manager

I:\CLERICAL\LETTERS\2013\13-100-DSL_ys.docx

From: Richelle Carino <rcarino@cityofdelano.org>
Sent: Monday, April 29, 2013 12:53 PM
To: Erik Ringelberg
Subject: FW: SCH2013031078

FYI

From: Noemi Zamudio
Sent: Wednesday, April 24, 2013 11:07 AM
To: Richelle Carino
Subject: RE: SCH2013031078

Richelle,

We will be adding a stop at that new shopping center. Not sure what other comments I can make?

From: Richelle Carino
Sent: Wednesday, April 24, 2013 10:56 AM
To: Maribel Reyna; Mark DeRosia; Noemi Zamudio; Roman Dowling
Subject: FW: SCH2013031078

Good morning. Friendly reminder that comments to the Grapevine EIR / NOP are due this Monday, April 29th at 4:00pm. This is an opportunity for you to determine whether this proposed project will have any potential impacts on the services that your Department provides. The scoping meeting will be held tomorrow (Thursday) at the Civic Center 5:30p-7:30p – if you have any questions particularly for the consultants that prepared the NOP, you are more than welcome to ask them tomorrow.

Thank you,
Richelle

From: Richelle Carino <rcarino@cityofdelano.org>
Sent: Monday, April 29, 2013 12:53 PM
To: Erik Ringelberg
Subject: FW: SCH2013031078

FYI

From: Mark DeRosia
Sent: Wednesday, April 24, 2013 12:48 PM
To: Richelle Carino
Subject: RE: SCH2013031078

I do not see any issues for law enforcement other than the standard ones that growth brings. The developer impact fees are always a nice thing. MD

From: Richelle Carino
Sent: Wednesday, April 24, 2013 10:56 AM
To: Maribel Reyna; Mark DeRosia; Noemi Zamudio; Roman Dowling
Subject: FW: SCH2013031078

Good morning. Friendly reminder that comments to the Grapevine EIR / NOP are due this Monday, April 29th at 4:00pm. This is an opportunity for you to determine whether this proposed project will have any potential impacts on the services that your Department provides. The scoping meeting will be held tomorrow (Thursday) at the Civic Center 5:30p-7:30p – if you have any questions particularly for the consultants that prepared the NOP, you are more than welcome to ask them tomorrow.

Thank you,
Richelle

City of Delano
Public Works / Engineering Department

Memorandum

TO: Richelle Carino, Community Development Director

FROM: Roman Dowling, PE, Public Works Director/ City Engineer

DATE: April 29, 2013

RE: Comments on Grapevine NOP

We have reviewed the NOP for the Grapevine Project and have the following comments:

1. Project Description – Utilities.

   a. **Water**: 12-inch water mains shall be installed along the frontage of Dover Parkway and Morse Boulevard, the 12-inch water main on Morse Boulevard shall be extended to and connected to the existing 12-inch water main on Albany Street in order to provide a loop for adequate water service to the project. All installations shall be in accordance with the City of Delano Subdivision Standards and to the satisfaction of the City Engineer.

   b. **Wastewater**: Adequate wastewater treatment capacity is available. A 12-inch sewer main shall be installed on Dover Parkway connecting to the existing 18-inch on Woollomes Ave. and extending north to Morse Boulevard. All installations shall be in accordance with the City of Delano Subdivision Standards and to the satisfaction of the City Engineer.

   c. **Storm Water**: The existing 60-inch storm drain line on Woollomes Ave. currently ends at a temporary basin located at the southeast corner of the proposed Grapevine project, that 60-inch line shall be extended west on Woollomes Ave. to Alabany St., then south on Albany St. (Stradley St.) approximately 500 feet, at which point a 60-inch lateral connection to the existing Regional Storm Drain Basin to the west side of the street shall be constructed to include an outlet structure. Adequate capacity to include the temporary basin mentioned and the necessary capacity to accommodate the Grapevine Project shall be excavated from the City's Regional Storm Drain Basin mentioned, the dirt export shall be used for fill as needed by the Grapevine Project. A 42-inch storm drain line shall be installed on Dover Parkway, connecting to the existing 60-inch on Woollomes Ave. and extending north along the frontage of the Grapevine Project up to the Morse Boulevard alignment. All installations shall be in accordance with the City of Delano Subdivision Standards and to the satisfaction of the City Engineer.

2. Under "Actions to implement the project," should add Subdivision Agreement, Building Permits, Development Impact Fees.

3. Section 9 Hydrology and Water Quality, item (J), This property is in Zone A of the FEMA Flood Hazards Maps, which is the 100-year flood hazard area, an Engineering Study to determine the Base Flood Elevation (BFE) shall be performed and requires FEMA approval.

4. Section 14 Public Services, item (a): Installation of 12-inch water mains on Dover Parkway and Morse Boulevard will partially mitigate the impact by providing adequate redundancy to the availability of water volume and pressure.

5. Section 16 Transportation and Traffic: Construction impacts to Woollomes Ave. will need to be mitigated by providing adequate temporary access lanes around the construction, complete closure of the road will not be allowed.

6. Section 17 Utilities and Service Systems: Also see comments under Project Description above.

    a. No Impact

    b. Should be "less than significant with mitigation", both for water and wastewater pipelines. 12-inch sewer main line installation on Dover Parkway will provide adequate mitigation for sewer collection system. The installation of 12-inch water mains on Dover Parkway and Morse Boulevard as described above will be adequate mitigation.

    c. See comment 1(c) above.

    d. Should be "less than significant with mitigation"

    e. Should be "less than significant with mitigation"

    f. This should be "No Impact".

    g. Agree

    h. Needs to be "Less than significant with mitigation".

Office Memorandum

KERN COUNTY

To: Community Development Department
City of Delano
Rachelle Carino

Date: April 15, 2013

From: Engineering, Surveying and Permit Services
Floodplain Management Section
Aaron Leicht, by Jason Scheer

Phone: (661) 862-5083
Email: ScheerJ@co.kern.ca.us

Subject: The Grapevine Project

From the information supplied, we have no comments or recommendations regarding the above project.

ROADS DEPARTMENT
CRAIG M. POPE, P.E., DIRECTOR
2700 "M" STREET, SUITE 400
BAKERSFIELD, CA 93301-2370
Phone: (661) 862-8850
FAX: (661) 862-8851
Toll Free: (800) 552-5376 Option 5
TTY Relay: (800) 735-2929
E-Mail: *roads@co.kern.ca.us*

DEVELOPMENT SERVICES AGENCY
Engineering, Surveying & Permit Services Department
Planning & Community Development Department
Roads Department

April 18, 2013

Ref.: 8-4.4 The Grapevine Project

Ms. Richelle Carino
Community Development Department
P.O. Box 3010
1005 11th Avenue
Delano, CA 93215

Subject: Notice of Preparation of a Draft Environmental Impact Report for The Grapevine Project (North side of Woollomes Avenue, between Albany Street/Stradley Avenue and State Route 99, Delano).

Dear Ms. Carino,

This department has reviewed the subject project and is requesting a copy of the traffic study for review and comment. We believe there will be significant impacts to Woollomes Avenue which is a non-engineered road that does not have the structural capacity to accommodate the increase in trips generated by this project.

We are specifically requesting that this concern be addressed by providing a comparative analysis of the structural capacity for Woollomes Avenue from the project site west to Albany Street/Stradley Avenue, with and without the project. The analysis will determine the necessary improvements required to mitigate the impacts associated with this project. The mitigation will likely require reconstruction of this segment however an asphalt concrete overlay may suffice if the existing road is able to accommodate the additional layer of asphalt concrete.

In addition, we would support any effort by the City of Delano to annex this portion of Woollomes Avenue, as it is the only segment between Lexington Street and Albany Street/Stradley Avenue that is not with the city limits.

Thank you for the opportunity to review and comment on this project. Should you have any questions please contact me at (661) 862-8645.

Sincerely,

Warren D, Maxwell
Engineering Manager

RECEIVED
APR 23 2013
By

Kern County
Superintendent
of Schools

Office of Christine Lizardi Frazier ...advocates for children

May 28, 2013

Richelle Carino, Director
Community Development
City of Delano
PO Box 3010
Delano, CA 93215

Our File No.: CO13-0020

RE: DEVELOPER FEES FOR: NOP/IS The Grapevine Project

Dear Ms. Carino:

This office represents the Delano Union and Delano Joint Union High School Districts with regard to the imposition of developer fees. We appreciate the opportunity to respond on behalf of these districts regarding the proposed project. This letter is limited to addressing the possible effects which the project might have on school facilities created by students attributable to the project. It is not intended to address other possible environmental concerns which might be identified by the district(s) after reviewing it.

Our office has determined the above-mentioned project proposes the development of a 328,500 square-foot shopping center to include a 12-screen theater, retail shops and restaurants, retailers, out parcels for fast food and drive through and sit down restaurants in a Community Retail Commercial (CRC) zone district will have no significant effects on either of these district's facilities so long as statutory school facilities fees are collected as required by law and that no further mitigation measures regarding school facilities are necessary. Currently these fees are $0.51 per square foot, an amount subject to increase January 2014.

Thank you for the opportunity to comment on the project. Should you have any questions, or if we can be of any further assistance in this matter, please contact me at 636-4599, or through e-mail at mabaker@kern.org.

Sincerely,

Christine Lizardi Frazier
County Superintendent of Schools

Mary Baker

Mary L. Baker, Manager
School District Facility Services

MLB
cc: District(s)
G:\DIVADMIN\SDFS\CORRES\2013\13-COUNTY\CO13-0020.DELANO.wpd

1300 17th Street - CITY CENTRE, Bakersfield, CA 93301-4533

(661) 636-4000 ● FAX (661) 636-4130 ● TDD (661) 636-4800 ● www.kern.org

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Partner - Kern County Network for Children

APPENDIX 3.3

AIR QUALITY AND GREENHOUSE GAS STUDIES

BSK

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Rancho Cordova CA 95670
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F 916.853.9297
www.bskassociates.com

Technical Memorandum

Subject: Grapevine Shopping Center Air Quality Study
Date: March 21, 2014
To: City of Delano
From: BSK Associates

The purpose of this Memorandum is to provide a detailed analysis, and a description of the air modeling used to identify pollutant emissions from the Grapevine Shopping Center Project in Delano, CA. BSK Associates calculated the project-related emissions from construction and operational sources. The methods used were both state and San Joaquin Valley Air Pollution Control District (SJVAPCD) approved air quality models and guidance tools. These models include the California Emissions Estimate Model (CalEEMod) Version 2013.2 and the SJVAPCD provided Mall Model Spreadsheet. The modeling assumptions, methods, and results are summarized below.

PROJECT-RELATED AIR EMISSIONS

This document was prepared pursuant to SJVAPCD Guide for Assessing and Mitigating Air Quality Impacts (GAMAQI), January 10, 2002 Revision. GAMAQI does not necessarily require a quantification of construction emissions for all projects. Emissions quantification is typically required only at the request of the lead agency. The SJVAPCD generally assumes that implementation of any construction-related mitigation measures will result in construction emissions impacts that are less than significant. The GAMAQI identifies thresholds that separate a project's short-term emissions from its long-term emissions.

In order to estimate emissions associated with the proposed project, several changes were made to the standard defaults provided in CalEEMod. These changes are detailed within the modeling program results that are provided in Attachment A and are explained further below.

CalEEMod ASSUMPTIONS

CalEEMod allows the user to change defaults within the program if site-specific information is supported with substantial evidence required by CEQA (CalEEMod, 2013; pg. 9). The CalEEMod modeling conducted relied on default values based on SJVAPCD data. These values influence

on-road vehicle emissions, trip lengths, water supply and treatment electricity use, solid waste disposal rates, amount of paved roads, days of landscaping equipment use, architectural coating emissions, and hearth usage (CalEEMod, 2013; pg. 11).

The project's land use was set as 328,500 square feet of "regional shopping center" with the remainder of the project site consisting of parking. These areas are based on the project description and Notice of Preparation (City of Delano, 2013; pg. 5).

The construction portion of CalEEMod assumed in the first year of construction, activities on the project site will consist of project site clearing, grading, detention basin expansion, and the beginning of construction of the proposed project. It is assumed that the following two years will consist of construction of the proposed project. Once construction is completed, architectural coating will occur on the project site. Buildout of the project site is assumed to be approximately 25% in the first year, 47% in the second year, and 28% in the third year. These phases were based on communications with Cornerstone Engineering and review of the Delano Marketplace Construction methods (City of Delano, 2007).

The operational aspect of the CalEEMod modeling utilized traffic volumes from the Traffic Impact Analysis Report conducted by Omni-Means (Omni-Means, 2014). This report utilized ITE Trip Generation Manual (9th Edition) Code 820 (Shopping Center) as the basis for project-related traffic.

The vegetation currently on the project site is an empty field with small amounts of vegetation. The new project will plant approximately 300 native trees that are tolerant to the Delano climate.

The CalEEMod model features mitigation measures for construction and operational phases, individually. According to NOP comments from SJVAPCD, construction will utilize add-on controls, cleaner fuels, or newer, lower emitting equipment of at least Tier II or better (SJVAPCD, 2013; pg. 2). Furthermore, the project site will be watered more frequently than recommended to meet PM_{10} and $PM_{2.5}$ requirements. Additional mitigation measures for both construction and operation impacts are described in Section 3.3 within the DEIR and within the modeling outputs.

Project-Emissions Results

The following are the CalEEMod emission results for the Grapevine Shopping Center before and after mitigation.

Table 1 represents the fugitive dust created during construction of the proposed project before mitigation.

TABLE 1 CONSTRUCTION-GENERATED TOTAL PM EMISSIONS BEFORE COMPLIANCE WITH SJVAPCD PM CONTROL PROVISIONS					
Sources	**Fugitive PM10** (Tons)	**Exhaust PM10** (Tons)	**Fugitive PM2.5** (Tons)	**Exhaust PM2.5** (Tons)	**Total PM** (Tons)
2014	0.86	0.38	0.25	0.35	1.84
2015	1.01	0.34	0.27	0.32	1.94
2016	0.45	0.13	0.12	0.12	0.82
Construction Total	**2.32**	**0.85**	**0.64**	**0.79**	**4.60**

Source: BSK Associates, 2014

These emissions are below the 15 tons per year PM_{10} threshold established by SJVAPCD and are therefore **less than significant**.

Table 2 represents the construction-generated ROG and NO_x from the proposed project without mitigation.

TABLE 2 CONSTRUCTION-GENERATED EMISSIONS OF ROG & NO_X WITHOUT MITIGATION		
Sources	**Emissions (tons/year)**	
	ROG	**NO_X**
SJVAPCD Thresholds (tons/year)	**10**	**10**
2014	1.39	9.05
2015	1.46	8.48
2016	1.43	3.25
Total Emissions	**4.28**	**20.78**

Source: BSK Associates, 2014

These emissions are below the 10 ton per year threshold established by SJVAPCD and are therefore considered **less than significant**.

Both NO_x and PM_{10} are required to meet percent reductions according to Indirect Source Review (ISR) Rule 9510. This reduction is demonstrated in Table 3. In accordance with this rule, exhaust emissions of NO_x from construction equipment greater than fifty (50) horsepower used or associated with the development project shall be reduced by 20 percent and reduce PM_{10} emissions by 45 percent (SJVAPCD, 2005; pg. 9510-11).
With Mitigation Measure **MM 3.3-2**, and Regulation VIII, Rule 8021 under SJVAPCD, both NO_x and PM_{10} meet their percent reductions with a 23% and 63% reduction, respectively. This satisfies an applicable air quality plan and is therefore considered **less than significant** with mitigation.

TABLE 3 CONSTRUCTION-GENERATED EMISSIONS OF NO_X AND PM_{10} WITH MITIGATION		
Sources	**NO_X Emissions with Mitigation (Tons)**	**PM_{10} Emission with Mitigation (Tons)**
SJVAPCD Thresholds (tons/year)	**10**	**15**
Percent Reduction Threshold	**20%**	**45%**
2014	6.64	0.46
2015	6.74	0.51
2016	2.54	0.22
Total Emissions	**15.93**	**1.19**
Percent Reduction	**23.36**	**62.60**

Source: BSK Associates, 2014

Table 4 represents the proposed project's operational emissions prior to mitigation compared to the SJVAPCD thresholds.

TABLE 4 PROPOSED PROJECT OPERATIONAL EMISSIONS WITHOUT MITIGATION				
Sources	**Emissions Generated (tons/year)**			
	ROG	**NO_X**	**PM_{10} Total**	**$PM_{2.5}$ Total**
SJVAPCD Thresholds (tons/year)	**10**	**10**	**15**	**Encompassed within PM_{10}**
Area Sources	7.29	$1.60e^{-004}$	$6.0e^{-005}$	$6.0e^{-005}$
Energy	0.01	0.11	$8.46e^{-03}$	$8.46e^{-03}$
Mobile Sources	12.75	35.43	10.27	3.06
Total Emissions	**20.05**	**35.54**	**10.27**	**3.06**

Source: BSK Associates, 2014

This table shows that both ROG and NO_x do not satisfy the 10 ton per year threshold and therefore are considered a potentially significant impacts. Table 5 represents the proposed project operational emissions with **MM 3.3-3** incorporated and the resulting percent reduction.

TABLE 5
OPERATIONAL EMISSIONS OF NO_x AND PM_{10} FOR PRE- AND POST-MITIGATION CONDITIONS

	Emissions Generated (tons/year)		
	NO_X	**ROG**	**PM_{10} Total**
Pre-Mitigation	35.54	20.05	10.28
Post-Mitigation	21.92	17.96	5.13
Total Reductions	13.61	2.09	5.15
Percentage Reduction Threshold	**33%**	**NA**	**50%**
Total Emission Percentage Reduction	**38.33%**	**10.44%**	**50.04%**

Source: BSK Associates, 2014

Both NO_x and PM_{10} meet the percent reduction required by ISR 9510; however only PM_{10} satisfies its yearly tonnage threshold. Both NO_x and ROG exceed their 10 ton/year threshold. With **MM 3.3-3**, project emissions of NO_x and PM_{10} achieve ISR 9510 percent reduction but NO_x and ROG fail to meet the 10 ton/year threshold. Therefore, after mitigation, operational emissions of regional pollutants of primary concern (NO_x and ROG) would be significant and unavoidable.

CUMULATIVE REGIONAL AIR QUALITY EMISSIONS

GHG Emissions

As indicated in Table 6, **MM 3.3-3** combined with the project's design features under the CalEEMod model, reduce the proposed project's operational GHG emissions by 44.26%. SJVAPCD GHG emission guidance states that in order for a project to be determined to have a less than significant cumulative impact on GHG emissions, a project must either implement SJVAPCD BPS, or achieve a 29% reduction in GHG emissions (SJVAPCD, 2009; pg. 5). The proposed project's GHG emission reduction project features meet the threshold described in SJVAPCD guidance, because they achieve a 29% reduction in GHG Emissions as estimated through CalEEMod. Therefore, the project's incremental contribution to cumulative GHG emissions is considered **less than significant**.

TABLE 6 CalEEMod PROPOSED PROJECT OPERATIONAL GHG EMISSIONS WITH AND WITHOUT PROJECT DESIGN FEATURES			
Greenhouse Gas	**Total CO_2 (MT/Year)**	**CH_4 (MT/Year)**	**N_20 (MT/Year)**
Without Features	16,237.22	4.64	0.03
With Features	8,638.93	2.02	0.02
Percent Reduction	**46.74**	**56.51**	**29.54**
Total Average Percent Reduction: =			**44.26**

Source: BSK Associates, 2014 Appendix 3.3

ROG and NO_x

Implementation of the proposed project would contribute to increases in emissions of ROG and NOX. However, with implementation of Mitigation Measure **MM 3.3-3**, the project's contribution to cumulative air quality impacts would be reduced, but not to a less than significant level. Thus, the proposed project's contribution to cumulative regional air quality conditions would be considered **significant and unavoidable**.

PROJECT-RELATED TOXIC AIR CONTAMINANTS

Stationary Source Toxic Air Contaminants

The proposed project consists primarily of retail stores, a 12-screen movie theater and various food venues, both fast food and sit-down. The project was analyzed for the "Opening Day" scenario, beginning of project operations, and a "Cumulative" scenario, with full area buildout of all surrounding development. The food venues are identified as the only stationary sources that have the potential to emit Area Source Toxic Air Contaminants (TAC). Under San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 2020, most retail food processing equipment is exempt from permitting requirements, except for charbroilers, which are subject to Rule 4692. The TACs emitted from fast food restaurants are Polycyclic Aromatic Hydrocarbons (PAH), with and without Naphalene. The SJVAPCD provided a dynamic "Mall HRA Screening" spreadsheet to BSK to evaluate the emissions and risk of TACs from fast food restaurants (SJVAPCD, 2014). This spreadsheet and the models conducted are provided in Attachment B. The district's default values were used to estimate the proposed project emissions. These values include pounds of meat per week, pounds of TAC emitted per ton of meat, and the number of fast food restaurants for the given project. Once all values are inputted, the spreadsheet produces a risk factor based on the nearest sensitive receptor location within a provided quadrant.

The dynamic spreadsheet is provided in the attachments and lists the district default values. This table shows four facility types. The project description for the proposed project indicates the potential for up to 13 food vendors, four of which are proposed fast food drive-through restaurants. This model took a conservative approach and modeled the risk as if all food

vendors are considered fast food restaurants, which have the highest TAC emissions. These stationary sources were summed to calculate the overall risk. The nearest sensitive receptor for the proposed project's "Opening Day" scenario in regards to air emissions is a daycare located north of the project. The sensitive receptor is located approximately 0.29 miles from the northern boundary of the project site.

Stationary Toxic Air Contaminants Results

With the district-provided default values and the 0.29 mile distance to the nearest sensitive receptor, the spreadsheet calculates a risk of 6.82 E-09 for Toxic Air Contaminants due to fast food production. This is less than the 10 in a million risk factor threshold determined by the SJVAPCD. Therefore, the proposed projects stationary sources TAC emissions are considered **less than significant**.

<u>Mobile Source Toxic Air Contaminants</u>

Carbon Monoxide Toxic Air Contaminant

The proposed project will increase traffic volumes along Woollomes Avenue and nearby roadways. The increase in traffic volumes creates the potential for high levels of carbon monoxide (CO). CO is a TAC and is monitored within the SJVAPCD. The SJVAPCD's threshold for CO is 9 parts per million (ppm) averaged over 8 hours and 20 ppm for 1 hour from the California Ambient Air Quality Standards (SJVAPCD, 2002; pg. 26).

Prior to conducting a full CO "hotspot" analysis, the SJVAPCD Guide for Assessing and Mitigating Air Quality Impacts (GAMAQI) states that if neither of the following criteria are met at all intersections affected by the development project, the project can be said to have no potential to create a violation of the CO standard:

"a traffic study for the project indicates Level of Service (LOS) on one or more streets or at one or more intersections in the project vicinity will be reduced to LOS E or F; or A traffic study indicates that the project will substantially worse an already existing LOS F on one or more streets or at more or more (sic) intersections in the project vicinity" (SJVAPCD, 2002; pg. 49).

Carbon Monoxide Toxic Air Contaminant Results

Prior to mitigation, the Woollomes Ave/Home Depot East intersection operates at LOS F. However, after mitigation, the intersection will operate at LOS C. The improved LOS brings all intersections within the criteria, and therefore according to the GAMAQI, there is no potential to create a violation of the CO standard (SJVAPCD, 2002; pg. 49).

Diesel Particulate Matter Toxic Air Contaminant

The "Mall HRA Screening" spreadsheet calculates levels of diesel particulate matter (DPM). The two workbooks within the spreadsheet used are the "Truck Idling" and "Truck Travel" tabs. Within the *Truck Idling* workbook, the truck idling times were set at 0.083 hours to stay

consistent with the required project 5 minute idle limit set forth by section 2485 of Title 13 the California Code of Regulations (CCR, 2006). The SJVAPCD default PM_{10} emissions factor of 2.57 g/hr. was used in the analysis. The 8,613 events per year is based on the average number of deliveries per day of 3 similar projects (City of Delano, 2007; pg. 3.3-50; City of Madera, 2012; pg. 3.2-47; City of Fresno, 2013; pg. 3.3-57). These projects average 33 delivery trucks per day, running 5 days per week, 52 weeks per year. As the ratio of truck refrigeration units (TRUs) and high horizontal (HH) is unknown, both were modeled and averaged. In reality, the type of trucks will vary from TRU, HH, and smaller delivery trucks. The sensitive receptor for opening day is the daycare located approximately 0.29 miles (460 m) north of the proposed project northern boundary and primarily in quadrant 4 in the model.

The *Truck Travel* workbook analyzed the truck travel emission starting from the SR 99 on and off ramps, moving west along Woollomes Ave., turning right on Dover Parkway and traveling north to Morse Blvd, then turning left on to Morse Blvd and entering the project site from the rear entrance. The midpoints of 50 meter segments along the roadways were used for the distance to the nearest receptor. The receptor quadrant varied depending on where the truck was along the roadway. This roadway consists of approximately 24 sections of 50 meters in length. Each segment of roadway was counted twice using two 50 meter segments to account for trucks entering and then leaving the project site. The SJVAPCD default PM_{10} emissions factor of 0.252 g/mi was used in the analysis. The 8,613 events per year is based on the average number of deliveries per day of 3 similar shopping center projects (City of Delano, 2007; pg. 3.3-50; City of Madera, 2012; pg. 3.2-47; City of Fresno, 2013; pg. 3.3-57).

Diesel Particulate Matter Toxic Air Contaminant Results

Using the district-provided spreadsheet for DPM risk, the risk associated with the project truck idling is 2.73 E-08 and truck travel is 5.30 E-08. These values do not exceed the 10 in 1 million risk threshold established by the SJVAPCD and therefore is considered **less than significant**.

Project Related Toxic Air Contaminants Results

The sum of toxic air contaminant emissions from all sources of the proposed project is 8.73 E-08. This does not exceed the 10 in 1 million threshold established by the SJVAPCD and therefore is considered **less than significant.**

CUMULATIVE TOXIC AIR CONTAMINANTS

Stationary Source Toxic Air Contaminants

For the cumulative conditions, which would include the buildout of the nearby residential development to the north, the analysis decreased the distance to the nearest sensitive receptor from the daycare to immediately north of the project. The nearest sensitive receptor was modeled as a residential land use located approximately 180 feet (55 m) north of the northern

project boundary. Cumulative TACs depend on the future mix of uses, which are not known. A surrogate approach was used to assess the potential TAC impacts on sensitive receptors. A conservative future scenario of 39 additional fast food restaurants (13 per development including the proposed project) was modeled to determine TACs from stationary sources. The cumulative TAC scenario represents the likely emissions from other future development projects planned in the area, in addition to the proposed project. Therefore, the cumulative modeling examined the TAC emissions from the likeliest TAC source (fast food restaurants) for each of the proposed developments, at the same ratio as the proposed project.

The analysis was completed by assessing the City of Delano Community Development Major Project Map and comparing it to the Major Project list, two new sources in the project area will potentially emit TACs (City of Delano, 2011a; City of Delano, 2011b). These developments are the Delano Vineyard Plaza (Map reference V) and the Community Retail Commercial and Residential (Map reference Y). The Delano Vineyard Plaza is approximately 52 acres and incorporates similar land uses to the proposed project. The Community Retail Commercial and Residential is approximately 77 acres with a combination of commercial and multiple family developments. This mix of developments is a reasonable surrogate for any likely development in this area given its zoning and history. While other mixes are possible, this mix considers the likely sources.

Stationary Source Toxic Air Contaminants Results

The conservative future scenario of 39 additional fast food restaurants calculated the potential cumulative TACs to be 5.60 E-07, based on the known cumulative sensitive receptor. The potential combined risks from the proposed project and approved/pending projects stationary TACs will not exceed the 10 in 1 million Maximum Exposed Individual (MEI) threshold, and are therefore considered **less than significant**.

<u>Mobile Source Toxic Air Contaminants</u>

Carbon Monoxide

For the cumulative conditions which would include the buildout of the nearby residences, the nearest sensitive receptor is a future residential land use located approximately 180 feet (55 m) north of the northern boundary of the project site. In the cumulative buildout scenario, the cumulative mobile source emissions of CO will be mitigated with the proposed roadway improvements set forth in the traffic study and listed in Mitigation Measures **MM 3.13-1a through MM 3.13-1c** and **MM 3.13-2a** through **MM 3.13-2g**.

These mitigation measures will decrease CO and DPM by improving traffic congestion and maintaining a LOS above “E” or “F”. This improved roadway and intersection movement will eliminate hotspots according to the SJVAPCD GAMAQI (SJVAPCD, 2002; pg. 49).

Cumulative Carbon Monoxide Toxic Air Contaminant Results

The cumulative improvements of the project's intersections and roadways raising LOS above "E" or "F" through mitigation measures reduces the CO impact to **a less than significant** level.

Diesel Particulate Matter

The cumulative threshold for DPM is the same 10 in 1 million MEI threshold for TACs. To determine the impacts from DPM on the nearest sensitive receptor, the truck idling and truck travel workbooks from the "Mall Model" spreadsheet were used. The same assumptions and values as the Opening Day scenario model runs for both truck idling and truck travel were used in the cumulative analysis with the exception of the sensitive receptor. The sensitive receptor in the cumulative scenario is the same future residential development located approximately 180 feet (55 m) north of the proposed project northern boundary and primarily in quadrant 4 in the model. A similar surrogate approach for the stationary source TACs was used in the cumulative DPM analysis. The sensitive receptor distance reflects the potential housing development with regards to loading bay proximity and the 5 minute idle time regulation (CCR, 2006).

Cumulative Diesel Particulate Matter Results

The cumulative DPM emissions from truck idling is 1.74 E-07 and truck travel is 7.80 E-07 for the proposed project and future developments. These emissions are below the 10 in 1 million MEI risk threshold and is therefore considered **less than significant**.

Cumulative Toxic Air Contaminant Results

The modeled sum of cumulative toxic air contaminant emissions from all sources of the proposed project and future development is 1.5 E-06. This does not exceed the 10 in 1 million threshold established by the SJVAPCD and therefore is considered **less than significant.**

References

California Code of Regulations (CCR), 2006; Title 13, § 2485 Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling. 2006

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City of Fresno, 2013. Westlake Development Project Draft Environmental Impact Report, prepared by Quad Knopf, April 2013; (http://www.fresno.gov/NR/rdonlyres/D299F047-98A6-4AAF-9FF7-286B1939E99E/0/WestlakeDEIR.pdf) web accessed February 27, 2014.

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San Joaquin Valley Air Pollution Control District, 2014. Mall Screening for Health Risk Assessment; (http://www.valleyair.org/busind/pto/Resources/resources_idx.htm) web accessed December 2013.

SJVAPCD, 2013. Comments on the Notice of Preparation/Initial Study for the Grapevine Project, District CEQA Reference No.: 20130309, April 11, 2013.
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SJVAPCD, 2002. Guide for Assessing and Mitigating Air Quality Impacts. August 20, 1998; January 10, 2002 revised.

Western Regional Climate Center, 2014. Prevailing Wind Direction by Month (1992-2002); (http://www.wrcc.dri.edu/htmlfiles/westwinddir.html) web accessed January 2014.

Attachment A

CalEEMod Reports for Grapevine Shopping Center Project and CEQA Alternatives

Grapevine-Standard3.19.14

San Joaquin Valley Unified APCD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	1,483.39	1000sqft	34.05	1,483,395.00	0
Regional Shopping Center	328.50	1000sqft	7.54	328,500.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	7			**Operational Year**	2016
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Outparcel project Data
Lot acreage based on outparcel map. missing acreage is assumed to be landscaping

Construction Phase - DURATIONS. Cornerstone Engineering.
Delano Marketplace Construction Time Frames.

Off-road Equipment - Duration 1.5 months

Off-road Equipment - Crane runs approximately 4 hours/day

Off-road Equipment - Duration: 1.8 months

Off-road Equipment - Detention Basin equipment

Off-road Equipment - Duration 3.6 months

Trips and VMT -
1.6 miles round trip from center of project site to detention basin entrance.

On-road Fugitive Dust - Mitigation Measures
Mean Vehicle Speed= 5mph

Grading - 9000 cy imported to project site as fill material.
Total acres=caleemod users guide pg. 26
24,000 CE email

Architectural Coating - Low VOC paint= < 50 g/L

Vehicle Trips - TIAR rate. based off of CalEEMod instructions. CalEEMod Appendix A page 20.

Road Dust - mitigation
5 mph vehicle speed

Area Coating - Low VOC paint= <50 g/L

Solid Waste -

Land Use Change - Unused ag land= Others
44.64 acres completely paved

Sequestration - 300 trees based on adding a tree at the end of each parking row.
Native trees that do not require much water. See reference.

Construction Off-road Equipment Mitigation - All equipment Tier 3.
Moisture Content on average of 10%-WRAP Handbook
Vehicle Speed= 5 mph
Water 4 times/day=74% reduction WRAP Table 3-7

Mobile Land Use Mitigation - 617 jobs/44.64=13.82
Inter./sq. mile: 640 acres/sq. mi.
project size =14.33 acres/sq mi.
*9 interesections= 129 inter/sq.m.
75 % of streets= dover, parkway belmont
50 % of streets= 6/9= 66%(conservative w/ 50)
18% parking reduction

Mobile Commute Mitigation - Implement Trip Reduction Program.
50% eligible. Required

Area Mitigation - LOW VOC paint =<50 g/L

Energy Mitigation - High efficiency LED lighting

Water Mitigation - 20% reduction per CA regulation.
Install Low Flow everything.

Waste Mitigation - 60% waste reduction

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	50.00
tblArchitecturalCoating	EF_Nonresidential_Interior	150.00	50.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	0.00
tblArchitecturalCoating	EF_Residential_Interior	150.00	0.00
tblAreaCoating	Area_EF_Nonresidential_Exterior	150	50
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	150	50
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	80
tblConstDustMitigation	WaterExposedAreaPM10PercentReduction	61	74
tblConstDustMitigation	WaterExposedAreaPM25PercentReduction	61	74
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstructionPhase	PhaseEndDate	8/16/2016	10/5/2016
tblConstructionPhase	PhaseEndDate	4/11/2017	5/31/2016
tblConstructionPhase	PhaseEndDate	6/13/2014	4/21/2014
tblConstructionPhase	PhaseEndDate	8/4/2014	6/10/2014
tblConstructionPhase	PhaseStartDate	6/1/2016	7/21/2016
tblConstructionPhase	PhaseStartDate	6/11/2014	4/22/2014
tblGrading	MaterialExported	0.00	24,000.00
tblGrading	MaterialImported	0.00	9,000.00
tblLandUse	LandUseSquareFeet	1,483,390.00	1,483,395.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	7.00	4.00
tblProjectCharacteristics	OperationalYear	2014	2016
tblSequestration	NumberOfNewTrees	0.00	300.00
tblSolidWaste	SolidWasteGenerationRate	344.93	290.32
tblTripsAndVMT	HaulingTripLength	20.00	1.60
tblVehicleTrips	ST_TR	49.97	44.79
tblVehicleTrips	SU_TR	25.24	44.79
tblVehicleTrips	WD_TR	42.94	44.79
tblWater	IndoorWaterUseRate	24,332,823.31	17,170,010.48
tblWater	OutdoorWaterUseRate	14,913,665.90	10,523,554.81

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.3972	9.0561	12.9049	0.0171	0.8620	0.3830	1.2451	0.2563	0.3566	0.6129	0.0000	1,506.9976	1,506.9976	0.1390	0.0000	1,509.9161
2015	1.4575	8.4766	14.1667	0.0216	1.0117	0.3437	1.3554	0.2741	0.3217	0.5958	0.0000	1,845.4264	1,845.4264	0.1211	0.0000	1,847.9698
2016	1.4290	3.2476	5.6096	9.4100e-003	0.4507	0.1346	0.5854	0.1220	0.1263	0.2483	0.0000	783.4046	783.4046	0.0499	0.0000	784.4526
Total	**4.2837**	**20.7803**	**32.6812**	**0.0482**	**2.3245**	**0.8613**	**3.1858**	**0.6524**	**0.8046**	**1.4570**	**0.0000**	**4,135.8286**	**4,135.8286**	**0.3100**	**0.0000**	**4,142.3386**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.9805	6.6453	12.3690	0.0171	0.2791	0.1804	0.4595	0.0936	0.1737	0.2673	0.0000	1,506.9972	1,506.9972	0.1390	0.0000	1,509.9157
2015	1.1021	6.7376	14.0485	0.0216	0.3408	0.1735	0.5143	0.1094	0.1664	0.2758	0.0000	1,845.4261	1,845.4261	0.1211	0.0000	1,847.9695
2016	1.2858	2.5430	5.5704	9.4100e-003	0.1509	0.0667	0.2176	0.0484	0.0642	0.1125	0.0000	783.4044	783.4044	0.0499	0.0000	784.4525
Total	**3.3684**	**15.9258**	**31.9879**	**0.0482**	**0.7708**	**0.4205**	**1.1913**	**0.2514**	**0.4042**	**0.6556**	**0.0000**	**4,135.8277**	**4,135.8277**	**0.3100**	**0.0000**	**4,142.3376**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**21.37**	**23.36**	**2.12**	**0.00**	**66.84**	**51.17**	**62.60**	**61.46**	**49.76**	**55.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	7.2941	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343
Energy	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	1,633.1016	1,633.1016	0.0718	0.0166	1,639.7559
Mobile	12.7465	35.4263	133.3171	0.1778	9.8088	0.4583	10.2671	2.6349	0.4209	3.0558	0.0000	14,502.5849	14,502.5849	0.5261	0.0000	14,513.6337
Waste						0.0000	0.0000		0.0000	0.0000	58.9323	0.0000	58.9323	3.4828	0.0000	132.0712
Water						0.0000	0.0000		0.0000	0.0000	5.4473	37.1271	42.5744	0.5612	0.0136	58.5642
Total	**20.0529**	**35.5378**	**133.4276**	**0.1784**	**9.8088**	**0.4668**	**10.2756**	**2.6349**	**0.4294**	**3.0643**	**64.3796**	**16,172.8460**	**16,237.2256**	**4.6420**	**0.0302**	**16,344.0593**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.6354	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343
Energy	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	982.9704	982.9704	0.0419	0.0104	987.0804
Mobile	11.3118	21.8058	107.0824	0.0937	4.8792	0.2458	5.1250	1.3107	0.2255	1.5361	0.0000	7,603.0192	7,603.0192	0.3090	0.0000	7,609.5073
Waste						0.0000	0.0000		0.0000	0.0000	20.6263	0.0000	20.6263	1.2190	0.0000	46.2249
Water						0.0000	0.0000		0.0000	0.0000	4.3578	27.9252	32.2830	0.4489	0.0108	45.0679
Total	**17.9594**	**21.9173**	**107.1930**	**0.0943**	**4.8792**	**0.2543**	**5.1335**	**1.3107**	**0.2340**	**1.5447**	**24.9841**	**8,613.9472**	**8,638.9313**	**2.0188**	**0.0213**	**8,687.9148**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**10.44**	**38.33**	**19.66**	**47.12**	**50.26**	**45.52**	**50.04**	**50.26**	**45.51**	**49.59**	**61.19**	**46.74**	**46.80**	**56.51**	**29.54**	**46.84**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	212.4000
Vegetation Land Change	-276.7680
Total	**-64.3680**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Grading	Grading	3/1/2014	4/21/2014	5	75	CE
2	Detention Basin Expansion	Grading	4/22/2014	6/10/2014	5	75	
3	Construction	Building Construction	4/22/2014	5/31/2016	5	740	DMP
4	Architectural Coating	Architectural Coating	7/21/2016	10/5/2016	5	55	DMP

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 90

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 559,503; Non-Residential Outdoor: 186,501 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Detention Basin Expansion	Excavators	1	8.00	162	0.38
Detention Basin Expansion	Graders	1	8.00	174	0.41
Detention Basin Expansion	Rubber Tired Dozers	1	8.00	255	0.40
Detention Basin Expansion	Scrapers	1	8.00	361	0.48
Detention Basin Expansion	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Construction	Cranes	1	4.00	226	0.29
Construction	Forklifts	3	8.00	89	0.20
Construction	Generator Sets	1	8.00	84	0.74
Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Grading	7	18.00	0.00	1,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Detention Basin Expansion	5	13.00	0.00	3,000.00	10.80	7.30	1.60	LD_Mix	HDT_Mix	HHDT
Construction	9	728.00	297.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	146.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0753	0.0000	0.0753	0.0311	0.0000	0.0311	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1156	1.3620	0.8669	1.0200e-003		0.0654	0.0654		0.0601	0.0601	0.0000	97.8716	97.8716	0.0289	0.0000	98.4790
Total	**0.1156**	**1.3620**	**0.8669**	**1.0200e-003**	**0.0753**	**0.0654**	**0.1406**	**0.0311**	**0.0601**	**0.0912**	**0.0000**	**97.8716**	**97.8716**	**0.0289**	**0.0000**	**98.4790**

3.2 Grading - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.8600e-003	0.1009	0.0921	2.0000e-004	8.3700e-003	1.8700e-003	0.0102	2.1900e-003	1.7200e-003	3.9100e-003	0.0000	18.9109	18.9109	1.7000e-004	0.0000	18.9145
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0105**	**0.1029**	**0.1120**	**2.3000e-004**	**0.0110**	**1.8900e-003**	**0.0129**	**2.8800e-003**	**1.7400e-003**	**4.6200e-003**	**0.0000**	**21.4088**	**21.4088**	**3.3000e-004**	**0.0000**	**21.4157**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0196	0.0000	0.0196	8.0900e-003	0.0000	8.0900e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0278	0.7305	0.6107	1.0200e-003		0.0223	0.0223		0.0223	0.0223	0.0000	97.8715	97.8715	0.0289	0.0000	98.4789
Total	**0.0278**	**0.7305**	**0.6107**	**1.0200e-003**	**0.0196**	**0.0223**	**0.0419**	**8.0900e-003**	**0.0223**	**0.0304**	**0.0000**	**97.8715**	**97.8715**	**0.0289**	**0.0000**	**98.4789**

3.2 Grading - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.8600e-003	0.1009	0.0921	2.0000e-004	2.6000e-003	1.8700e-003	4.4700e-003	7.7000e-004	1.7200e-003	2.4900e-003	0.0000	18.9109	18.9109	1.7000e-004	0.0000	18.9145
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	8.0000e-004	2.0000e-005	8.2000e-004	2.5000e-004	2.0000e-005	2.7000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0105**	**0.1029**	**0.1120**	**2.3000e-004**	**3.4000e-003**	**1.8900e-003**	**5.2900e-003**	**1.0200e-003**	**1.7400e-003**	**2.7600e-003**	**0.0000**	**21.4088**	**21.4088**	**3.3000e-004**	**0.0000**	**21.4157**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0666	0.0000	0.0666	0.0302	0.0000	0.0302	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0827	0.9555	0.6088	6.9000e-004		0.0465	0.0465		0.0428	0.0428	0.0000	66.6469	66.6469	0.0197	0.0000	67.0605
Total	**0.0827**	**0.9555**	**0.6088**	**6.9000e-004**	**0.0666**	**0.0465**	**0.1132**	**0.0302**	**0.0428**	**0.0730**	**0.0000**	**66.6469**	**66.6469**	**0.0197**	**0.0000**	**67.0605**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0142	0.0379	0.1958	6.0000e-005	1.8000e-003	4.8000e-004	2.2800e-003	4.7000e-004	4.4000e-004	9.1000e-004	0.0000	5.1380	5.1380	7.0000e-005	0.0000	5.1395
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	1.8700e-003	2.0000e-005	1.8900e-003	5.0000e-004	2.0000e-005	5.1000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0153**	**0.0394**	**0.2102**	**8.0000e-005**	**3.6700e-003**	**5.0000e-004**	**4.1700e-003**	**9.7000e-004**	**4.6000e-004**	**1.4200e-003**	**0.0000**	**6.9421**	**6.9421**	**1.8000e-004**	**0.0000**	**6.9459**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0173	0.0000	0.0173	7.8600e-003	0.0000	7.8600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0199	0.4908	0.4255	6.9000e-004		0.0153	0.0153		0.0153	0.0153	0.0000	66.6468	66.6468	0.0197	0.0000	67.0604
Total	**0.0199**	**0.4908**	**0.4255**	**6.9000e-004**	**0.0173**	**0.0153**	**0.0326**	**7.8600e-003**	**0.0153**	**0.0231**	**0.0000**	**66.6468**	**66.6468**	**0.0197**	**0.0000**	**67.0604**

3.3 Detention Basin Expansion - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0142	0.0379	0.1958	6.0000e-005	5.7000e-004	4.8000e-004	1.0500e-003	1.7000e-004	4.4000e-004	6.1000e-004	0.0000	5.1380	5.1380	7.0000e-005	0.0000	5.1395
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	5.8000e-004	2.0000e-005	5.9000e-004	1.8000e-004	2.0000e-005	1.9000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0153**	**0.0394**	**0.2102**	**8.0000e-005**	**1.1500e-003**	**5.0000e-004**	**1.6400e-003**	**3.5000e-004**	**4.6000e-004**	**8.0000e-004**	**0.0000**	**6.9421**	**6.9421**	**1.8000e-004**	**0.0000**	**6.9459**

3.4 Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3259	2.5340	1.6151	2.2500e-003		0.1885	0.1885		0.1778	0.1778	0.0000	205.1293	205.1293	0.0514	0.0000	206.2086
Total	**0.3259**	**2.5340**	**1.6151**	**2.2500e-003**		**0.1885**	**0.1885**		**0.1778**	**0.1778**	**0.0000**	**205.1293**	**205.1293**	**0.0514**	**0.0000**	**206.2086**

3.4 Construction - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5203	3.6525	5.4141	6.4800e-003	0.1759	0.0755	0.2514	0.0504	0.0694	0.1197	0.0000	598.2526	598.2526	6.5900e-003	0.0000	598.3909
Worker	0.3269	0.4099	4.0778	6.3900e-003	0.5296	4.7700e-003	0.5344	0.1408	4.3300e-003	0.1451	0.0000	510.7463	510.7463	0.0319	0.0000	511.4155
Total	**0.8472**	**4.0624**	**9.4919**	**0.0129**	**0.7055**	**0.0803**	**0.7858**	**0.1912**	**0.0737**	**0.2648**	**0.0000**	**1,108.9990**	**1,108.9990**	**0.0385**	**0.0000**	**1,109.8064**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0598	1.2194	1.5187	2.2500e-003		0.0602	0.0602		0.0602	0.0602	0.0000	205.1291	205.1291	0.0514	0.0000	206.2083
Total	**0.0598**	**1.2194**	**1.5187**	**2.2500e-003**		**0.0602**	**0.0602**		**0.0602**	**0.0602**	**0.0000**	**205.1291**	**205.1291**	**0.0514**	**0.0000**	**206.2083**

3.4 Construction - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5203	3.6525	5.4141	6.4800e-003	0.0748	0.0755	0.1502	0.0256	0.0694	0.0949	0.0000	598.2526	598.2526	6.5900e-003	0.0000	598.3909
Worker	0.3269	0.4099	4.0778	6.3900e-003	0.1629	4.7700e-003	0.1677	0.0508	4.3300e-003	0.0551	0.0000	510.7463	510.7463	0.0319	0.0000	511.4155
Total	**0.8472**	**4.0624**	**9.4919**	**0.0129**	**0.2377**	**0.0803**	**0.3179**	**0.0763**	**0.0737**	**0.1500**	**0.0000**	**1,108.9990**	**1,108.9990**	**0.0385**	**0.0000**	**1,109.8064**

3.4 Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4412	3.4878	2.2961	3.2200e-003		0.2566	0.2566		0.2416	0.2416	0.0000	292.1149	292.1149	0.0720	0.0000	293.6277
Total	**0.4412**	**3.4878**	**2.2961**	**3.2200e-003**		**0.2566**	**0.2566**		**0.2416**	**0.2416**	**0.0000**	**292.1149**	**292.1149**	**0.0720**	**0.0000**	**293.6277**

3.4 Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6050	4.4728	6.7534	9.2500e-003	0.2522	0.0808	0.3330	0.0722	0.0743	0.1465	0.0000	846.2270	846.2270	8.0500e-003	0.0000	846.3960
Worker	0.4114	0.5160	5.1172	9.1700e-003	0.7595	6.3100e-003	0.7658	0.2019	5.7600e-003	0.2076	0.0000	707.0846	707.0846	0.0410	0.0000	707.9461
Total	**1.0163**	**4.9888**	**11.8706**	**0.0184**	**1.0117**	**0.0871**	**1.0988**	**0.2741**	**0.0800**	**0.3541**	**0.0000**	**1,553.3116**	**1,553.3116**	**0.0491**	**0.0000**	**1,554.3421**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0857	1.7487	2.1779	3.2200e-003		0.0864	0.0864		0.0864	0.0864	0.0000	292.1145	292.1145	0.0720	0.0000	293.6273
Total	**0.0857**	**1.7487**	**2.1779**	**3.2200e-003**		**0.0864**	**0.0864**		**0.0864**	**0.0864**	**0.0000**	**292.1145**	**292.1145**	**0.0720**	**0.0000**	**293.6273**

3.4 Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.6050	4.4728	6.7534	9.2500e-003	0.1072	0.0808	0.1880	0.0366	0.0743	0.1109	0.0000	846.2270	846.2270	8.0500e-003	0.0000	846.3960
Worker	0.4114	0.5160	5.1172	9.1700e-003	0.2336	6.3100e-003	0.2400	0.0728	5.7600e-003	0.0786	0.0000	707.0846	707.0846	0.0410	0.0000	707.9461
Total	**1.0163**	**4.9888**	**11.8706**	**0.0184**	**0.3408**	**0.0871**	**0.4279**	**0.1094**	**0.0800**	**0.1894**	**0.0000**	**1,553.3116**	**1,553.3116**	**0.0491**	**0.0000**	**1,554.3421**

3.4 Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1694	1.3666	0.9389	1.3300e-003		0.0984	0.0984		0.0926	0.0926	0.0000	119.9935	119.9935	0.0292	0.0000	120.6064
Total	**0.1694**	**1.3666**	**0.9389**	**1.3300e-003**		**0.0984**	**0.0984**		**0.0926**	**0.0926**	**0.0000**	**119.9935**	**119.9935**	**0.0292**	**0.0000**	**120.6064**

3.4 Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2199	1.6079	2.5658	3.8200e-003	0.1044	0.0281	0.1325	0.0299	0.0258	0.0557	0.0000	345.9366	345.9366	3.0200e-003	0.0000	345.9999
Worker	0.1499	0.1887	1.8629	3.7900e-003	0.3143	2.4600e-003	0.3168	0.0835	2.2600e-003	0.0858	0.0000	281.6842	281.6842	0.0153	0.0000	282.0058
Total	**0.3698**	**1.7965**	**4.4286**	**7.6100e-003**	**0.4187**	**0.0306**	**0.4492**	**0.1134**	**0.0281**	**0.1415**	**0.0000**	**627.6207**	**627.6207**	**0.0183**	**0.0000**	**628.0057**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0355	0.7236	0.9012	1.3300e-003		0.0357	0.0357		0.0357	0.0357	0.0000	119.9934	119.9934	0.0292	0.0000	120.6062
Total	**0.0355**	**0.7236**	**0.9012**	**1.3300e-003**		**0.0357**	**0.0357**		**0.0357**	**0.0357**	**0.0000**	**119.9934**	**119.9934**	**0.0292**	**0.0000**	**120.6062**

3.4 Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2199	1.6079	2.5658	3.8200e-003	0.0444	0.0281	0.0725	0.0152	0.0258	0.0410	0.0000	345.9366	345.9366	3.0200e-003	0.0000	345.9999
Worker	0.1499	0.1887	1.8629	3.7900e-003	0.0967	2.4600e-003	0.0991	0.0301	2.2600e-003	0.0324	0.0000	281.6842	281.6842	0.0153	0.0000	282.0058
Total	**0.3698**	**1.7965**	**4.4286**	**7.6100e-003**	**0.1410**	**0.0306**	**0.1716**	**0.0453**	**0.0281**	**0.0734**	**0.0000**	**627.6207**	**627.6207**	**0.0183**	**0.0000**	**628.0057**

3.5 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8644					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0101	0.0652	0.0518	8.0000e-005		5.4100e-003	5.4100e-003		5.4100e-003	5.4100e-003	0.0000	7.0215	7.0215	8.3000e-004	0.0000	7.0388
Total	**0.8746**	**0.0652**	**0.0518**	**8.0000e-005**		**5.4100e-003**	**5.4100e-003**		**5.4100e-003**	**5.4100e-003**	**0.0000**	**7.0215**	**7.0215**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0153	0.0193	0.1903	3.9000e-004	0.0321	2.5000e-004	0.0324	8.5300e-003	2.3000e-004	8.7600e-003	0.0000	28.7689	28.7689	1.5600e-003	0.0000	28.8017
Total	**0.0153**	**0.0193**	**0.1903**	**3.9000e-004**	**0.0321**	**2.5000e-004**	**0.0324**	**8.5300e-003**	**2.3000e-004**	**8.7600e-003**	**0.0000**	**28.7689**	**28.7689**	**1.5600e-003**	**0.0000**	**28.8017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8644					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	3.5400e-003	0.0504	8.0000e-005		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	7.0214	7.0214	8.3000e-004	0.0000	7.0388
Total	**0.8653**	**3.5400e-003**	**0.0504**	**8.0000e-005**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**7.0214**	**7.0214**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0153	0.0193	0.1903	3.9000e-004	9.8700e-003	2.5000e-004	0.0101	3.0800e-003	2.3000e-004	3.3100e-003	0.0000	28.7689	28.7689	1.5600e-003	0.0000	28.8017
Total	**0.0153**	**0.0193**	**0.1903**	**3.9000e-004**	**9.8700e-003**	**2.5000e-004**	**0.0101**	**3.0800e-003**	**2.3000e-004**	**3.3100e-003**	**0.0000**	**28.7689**	**28.7689**	**1.5600e-003**	**0.0000**	**28.8017**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Density

Increase Diversity

Improve Walkability Design

Improve Destination Accessibility

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

Implement NEV Network

Limit Parking Supply

Increase Transit Frequency

Implement Trip Reduction Program

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	11.3118	21.8058	107.0824	0.0937	4.8792	0.2458	5.1250	1.3107	0.2255	1.5361	0.0000	7,603.0192	7,603.0192	0.3090	0.0000	7,609.5073
Unmitigated	12.7465	35.4263	133.3171	0.1778	9.8088	0.4583	10.2671	2.6349	0.4209	3.0558	0.0000	14,502.5849	14,502.5849	0.5261	0.0000	14,513.6337

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	14,713.52	14,713.52	14713.52	25,797,277	12,832,314
Total	14,713.52	14,713.52	14,713.52	25,797,277	12,832,314

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
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Regional Shopping Center	9.50	7.30	7.30	16.30	64.70	19.00	54	35	11

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.413014	0.062673	0.156172	0.176687	0.051255	0.007895	0.018867	0.100331	0.001803	0.001598	0.006448	0.000946	0.002310

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: Y

5.1 Mitigation Measures Energy

Install High Efficiency Lighting

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	861.8380	861.8380	0.0396	8.2000e-003	865.2108
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	1,511.9692	1,511.9692	0.0695	0.0144	1,517.8864
NaturalGas Mitigated	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.1324	121.1324	2.3200e-003	2.2200e-003	121.8696
NaturalGas Unmitigated	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.1324	121.1324	2.3200e-003	2.2200e-003	121.8696

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					
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	2.26994e+006	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.1324	121.1324	2.3200e-003	2.2200e-003	121.8696
Total		**0.0122**	**0.1113**	**0.0935**	**6.7000e-004**		**8.4600e-003**	**8.4600e-003**		**8.4600e-003**	**8.4600e-003**	**0.0000**	**121.1324**	**121.1324**	**2.3200e-003**	**2.2200e-003**	**121.8696**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Regional Shopping Center	2.26994e+006	0.0122	0.1113	0.0935	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.1324	121.1324	2.3200e-003	2.2200e-003	121.8696
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0122**	**0.1113**	**0.0935**	**6.7000e-004**		**8.4600e-003**	**8.4600e-003**		**8.4600e-003**	**8.4600e-003**	**0.0000**	**121.1324**	**121.1324**	**2.3200e-003**	**2.2200e-003**	**121.8696**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Parking Lot	1.30539e+006	373.5587	0.0172	3.5500e-003	375.0206
Regional Shopping Center	3.97814e+006	1,138.4105	0.0523	0.0108	1,142.8657
Total		**1,511.9692**	**0.0695**	**0.0144**	**1,517.8864**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Parking Lot	352455	100.8609	4.6400e-003	9.6000e-004	101.2556
Regional Shopping Center	2.65921e+006	760.9771	0.0350	7.2400e-003	763.9552
Total		**861.8380**	**0.0396**	**8.2000e-003**	**865.2108**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

No Hearths Installed

Use Low VOC Cleaning Supplies

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	6.6354	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343
Unmitigated	7.2941	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.2161					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	7.0764					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6600e-003	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343
Total	**7.2941**	**1.6000e-004**	**0.0171**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0324**	**0.0324**	**9.0000e-005**	**0.0000**	**0.0343**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0864					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	6.5473					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6600e-003	1.6000e-004	0.0171	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0324	0.0324	9.0000e-005	0.0000	0.0343
Total	**6.6354**	**1.6000e-004**	**0.0171**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0324**	**0.0324**	**9.0000e-005**	**0.0000**	**0.0343**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Turf Reduction

Use Water Efficient Irrigation System

Use Water Efficient Landscaping

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	32.2830	0.4489	0.0108	45.0679
Unmitigated	42.5744	0.5612	0.0136	58.5642

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	17.17 / 10.5236	42.5744	0.5612	0.0136	58.5642
Total		**42.5744**	**0.5612**	**0.0136**	**58.5642**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	13.736 / 8.41884	32.2830	0.4489	0.0108	45.0679
Total		**32.2830**	**0.4489**	**0.0108**	**45.0679**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	20.6263	1.2190	0.0000	46.2249
Unmitigated	58.9323	3.4828	0.0000	132.0712

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	290.32	58.9323	3.4828	0.0000	132.0712
Total		**58.9323**	**3.4828**	**0.0000**	**132.0712**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	101.612	20.6263	1.2190	0.0000	46.2249
Total		**20.6263**	**1.2190**	**0.0000**	**46.2249**

9.0 Operational Offroad

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

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	-64.3680	0.0000	0.0000	-64.3680

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Cropland	44.64 / 0	-276.7680	0.0000	0.0000	-276.7680
Total		**-276.7680**	**0.0000**	**0.0000**	**-276.7680**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Aspen	0	0.0000	0.0000	0.0000	0.0000
Hardwood Maple	0	0.0000	0.0000	0.0000	0.0000
Juniper	0	0.0000	0.0000	0.0000	0.0000
Miscellaneous	300	212.4000	0.0000	0.0000	212.4000
Mixed Hardwood	0	0.0000	0.0000	0.0000	0.0000
Soft Maple	0	0.0000	0.0000	0.0000	0.0000
Total		**212.4000**	**0.0000**	**0.0000**	**212.4000**

Grapevine-2Alternative3.19.14

San Joaquin Valley Unified APCD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	1,483.39	1000sqft	34.05	1,483,395.00	0
Regional Shopping Center	264.50	1000sqft	6.07	264,500.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	7			**Operational Year**	2016
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Outparcel

Construction Phase - DURATIONS

Off-road Equipment - Duration 1.5 months

Off-road Equipment - Crane runs approximately 4 hours/day

Off-road Equipment - Duration: 1.8 months

Off-road Equipment - Detention Basin equipment

Off-road Equipment - Duration 3.6 months

Trips and VMT - Check

1.6 miles round trip from center of project site to detention basin entrance.
On-road Fugitive Dust - Mitigation Measures
Mean Vehicle Speed= 5mph

Grading - 9000 cy imported to project site as fill material.
Vehicle Speed= 5 mph(mitigation measure)
Total acres=project site size

Architectural Coating - Low VOC paint= < 50 g/L

Vehicle Trips - TIAR rate based off of CalEEMod Appendix A page 20.

Road Dust - mitigation
5 mph vehicle speed

Area Coating - Low VOC paint= <50 g/L

Land Use Change - Unused ag land= Others
44.64 acres to completely paved

Sequestration - 300 trees based on adding a tree at the end of each parking row.
Native trees taht do not require much water. See reference.

Construction Off-road Equipment Mitigation - All equipment Tier 3.
Moisture Content on average of 10%-WRAP Handbook
Vehicle Speed= 5 mph
Water 4 times/day=74% reduction WRAP Table 3-7

Mobile Land Use Mitigation - 617 jobs/44.64=13.82
Inter./sq. mile: 640 acres/sq. mi.
project size =14.33 acres/sq mi.
*9 interesections= 129 inter/sq.m.
75 % of streets= dover, parkway belmont
50 % of streets= 6/9= 66%(conservative w/ 50)
18% reduction in parking

Mobile Commute Mitigation - Implement Trip Reduction Program.
50% eligible. Required

Area Mitigation - LOW VOC paint =<50 g/L

Energy Mitigation - High efficiency LED lighting

Water Mitigation - 20% reduction per CA regulation.
Install Low Flow everything.

Waste Mitigation - 60% waste reduction

Water And Wastewater -

Solid Waste -

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	50.00
tblArchitecturalCoating	EF_Nonresidential_Interior	150.00	50.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	0.00
tblArchitecturalCoating	EF_Residential_Interior	150.00	0.00
tblAreaCoating	Area_EF_Nonresidential_Exterior	150	50
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	150	50
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	80
tblConstDustMitigation	WaterExposedAreaPM10PercentReduction	61	74
tblConstDustMitigation	WaterExposedAreaPM25PercentReduction	61	74
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstructionPhase	NumDays	740.00	551.00
tblConstructionPhase	NumDays	75.00	36.00
tblConstructionPhase	NumDays	75.00	36.00
tblConstructionPhase	PhaseEndDate	5/31/2016	5/30/2016
tblConstructionPhase	PhaseEndDate	6/10/2014	4/21/2014
tblConstructionPhase	PhaseStartDate	4/22/2014	4/21/2014
tblConstructionPhase	PhaseStartDate	4/22/2014	3/1/2014
tblGrading	MaterialExported	0.00	24,000.00
tblGrading	MaterialImported	0.00	9,000.00
tblLandUse	LandUseSquareFeet	1,483,390.00	1,483,395.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	7.00	4.00
tblProjectCharacteristics	OperationalYear	2014	2016
tblSequestration	NumberOfNewTrees	0.00	300.00
tblTripsAndVMT	HaulingTripLength	20.00	1.60
tblVehicleTrips	ST_TR	49.97	44.79
tblVehicleTrips	SU_TR	25.24	44.79
tblVehicleTrips	WD_TR	42.94	44.79

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.3941	9.0789	12.8782	0.0171	0.9978	0.3839	1.3817	0.3182	0.3574	0.6757	0.0000	1,501.6460	1,501.6460	0.1386	0.0000	1,504.5562
2015	1.4238	8.2968	13.7760	0.0211	0.9815	0.3405	1.3220	0.2659	0.3187	0.5846	0.0000	1,794.6593	1,794.6593	0.1197	0.0000	1,797.1728
2016	1.2631	3.1537	5.4098	9.0700e-003	0.4336	0.1323	0.5659	0.1173	0.1242	0.2415	0.0000	755.3333	755.3333	0.0489	0.0000	756.3601
Total	**4.0810**	**20.5293**	**32.0640**	**0.0472**	**2.4129**	**0.8567**	**3.2696**	**0.7014**	**0.8003**	**1.5018**	**0.0000**	**4,051.6386**	**4,051.6386**	**0.3072**	**0.0000**	**4,058.0890**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.9731	6.3459	12.3418	0.0171	0.3140	0.1800	0.4940	0.1094	0.1732	0.2827	0.0000	1,501.6456	1,501.6456	0.1386	0.0000	1,504.5557
2015	1.0684	6.5577	13.6578	0.0211	0.3304	0.1703	0.5007	0.1061	0.1635	0.2695	0.0000	1,794.6589	1,794.6589	0.1197	0.0000	1,797.1724
2016	1.1211	2.4550	5.3710	9.0700e-003	0.1451	0.0649	0.2100	0.0465	0.0626	0.1090	0.0000	755.3331	755.3331	0.0489	0.0000	756.3600
Total	**3.1626**	**15.3587**	**31.3706**	**0.0472**	**0.7895**	**0.4152**	**1.2047**	**0.2620**	**0.3993**	**0.6612**	**0.0000**	**4,051.6376**	**4,051.6376**	**0.3072**	**0.0000**	**4,058.0881**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**22.50**	**25.19**	**2.16**	**0.00**	**67.28**	**51.54**	**63.16**	**62.65**	**50.11**	**55.97**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	7.0070	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331
Energy	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	1,387.7112	1,387.7112	0.0612	0.0141	1,393.3539
Mobile	10.2632	28.5244	107.3436	0.1431	7.8978	0.3690	8.2668	2.1216	0.3389	2.4604	0.0000	11,677.1193	11,677.1193	0.4236	0.0000	11,686.0156
Waste						0.0000	0.0000		0.0000	0.0000	56.3767	0.0000	56.3767	3.3318	0.0000	126.3438
Water						0.0000	0.0000		0.0000	0.0000	6.2157	42.3646	48.5803	0.6404	0.0155	66.8258
Total	**17.2801**	**28.6141**	**107.4353**	**0.1437**	**7.8978**	**0.3759**	**8.2737**	**2.1216**	**0.3457**	**2.4673**	**62.5924**	**13,107.2264**	**13,169.8188**	**4.4570**	**0.0295**	**13,272.5722**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.3892	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331
Energy	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	811.1134	811.1134	0.0347	8.5700e-003	814.4996
Mobile	9.1180	17.6528	86.4037	0.0760	3.9631	0.1994	4.1625	1.0646	0.1829	1.2475	0.0000	6,170.0375	6,170.0375	0.2503	0.0000	6,175.2934
Waste						0.0000	0.0000		0.0000	0.0000	19.7318	0.0000	19.7318	1.1661	0.0000	44.2203
Water						0.0000	0.0000		0.0000	0.0000	4.9726	31.8646	36.8372	0.5122	0.0124	51.4256
Total	**15.5171**	**17.7426**	**86.4954**	**0.0766**	**3.9631**	**0.2063**	**4.1694**	**1.0646**	**0.1898**	**1.2544**	**24.7044**	**7,013.0467**	**7,037.7511**	**1.9634**	**0.0209**	**7,085.4720**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**10.20**	**37.99**	**19.49**	**46.71**	**49.82**	**45.12**	**49.61**	**49.82**	**45.11**	**49.16**	**60.53**	**46.49**	**46.56**	**55.95**	**29.15**	**46.62**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	212.4000
Vegetation Land Change	0.0000
Total	**212.4000**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Grading	Grading	3/1/2014	4/21/2014	5	36	CE
2	Detention Basin Expansion	Grading	3/1/2014	4/21/2014	5	36	
3	Construction	Building Construction	4/21/2014	5/30/2016	5	551	DMP
4	Architectural Coating	Architectural Coating	5/31/2016	8/15/2016	5	55	DMP

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 90

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 463,503; Non-Residential Outdoor: 154,501 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Detention Basin Expansion	Excavators	1	8.00	162	0.38
Detention Basin Expansion	Graders	1	8.00	174	0.41
Detention Basin Expansion	Rubber Tired Dozers	1	8.00	255	0.40
Detention Basin Expansion	Scrapers	1	8.00	361	0.48
Detention Basin Expansion	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Construction	Cranes	1	4.00	226	0.29
Construction	Forklifts	3	8.00	89	0.20
Construction	Generator Sets	1	8.00	84	0.74
Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Grading	7	18.00	0.00	1,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Detention Basin Expansion	5	13.00	0.00	2,373.00	10.80	7.30	1.60	LD_Mix	HDT_Mix	HHDT
Construction	9	708.00	286.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	142.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1568	0.0000	0.1568	0.0648	0.0000	0.0648	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1156	1.3620	0.8669	1.0200e-003		0.0654	0.0654		0.0601	0.0601	0.0000	97.8716	97.8716	0.0289	0.0000	98.4790
Total	**0.1156**	**1.3620**	**0.8669**	**1.0200e-003**	**0.1568**	**0.0654**	**0.2221**	**0.0648**	**0.0601**	**0.1250**	**0.0000**	**97.8716**	**97.8716**	**0.0289**	**0.0000**	**98.4790**

3.2 Grading - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	9.6200e-003	3.8900e-003	0.0135	2.6500e-003	3.5800e-003	6.2300e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**0.0122**	**3.9100e-003**	**0.0161**	**3.3400e-003**	**3.6000e-003**	**6.9400e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0408	0.0000	0.0408	0.0169	0.0000	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.5326	0.6107	1.0200e-003		0.0220	0.0220		0.0220	0.0220	0.0000	97.8715	97.8715	0.0289	0.0000	98.4789
Total	**0.0265**	**0.5326**	**0.6107**	**1.0200e-003**	**0.0408**	**0.0220**	**0.0628**	**0.0169**	**0.0220**	**0.0389**	**0.0000**	**97.8715**	**97.8715**	**0.0289**	**0.0000**	**98.4789**

3.2 Grading - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	3.8600e-003	3.8900e-003	7.7500e-003	1.2300e-003	3.5800e-003	4.8100e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	8.0000e-004	2.0000e-005	8.2000e-004	2.5000e-004	2.0000e-005	2.7000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**4.6600e-003**	**3.9100e-003**	**8.5700e-003**	**1.4800e-003**	**3.6000e-003**	**5.0800e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1370	0.0000	0.1370	0.0627	0.0000	0.0627	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0827	0.9555	0.6088	6.9000e-004		0.0465	0.0465		0.0428	0.0428	0.0000	66.6469	66.6469	0.0197	0.0000	67.0605
Total	**0.0827**	**0.9555**	**0.6088**	**6.9000e-004**	**0.1370**	**0.0465**	**0.1836**	**0.0627**	**0.0428**	**0.1055**	**0.0000**	**66.6469**	**66.6469**	**0.0197**	**0.0000**	**67.0605**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	1.6500e-003	7.9000e-004	2.4300e-003	4.6000e-004	7.2000e-004	1.1800e-003	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	1.8700e-003	2.0000e-005	1.8900e-003	5.0000e-004	2.0000e-005	5.1000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**3.5200e-003**	**8.1000e-004**	**4.3200e-003**	**9.6000e-004**	**7.4000e-004**	**1.6900e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0356	0.0000	0.0356	0.0163	0.0000	0.0163	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0185	0.3738	0.4255	6.9000e-004		0.0150	0.0150		0.0150	0.0150	0.0000	66.6468	66.6468	0.0197	0.0000	67.0604
Total	**0.0185**	**0.3738**	**0.4255**	**6.9000e-004**	**0.0356**	**0.0150**	**0.0506**	**0.0163**	**0.0150**	**0.0313**	**0.0000**	**66.6468**	**66.6468**	**0.0197**	**0.0000**	**67.0604**

3.3 Detention Basin Expansion - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	6.7000e-004	7.9000e-004	1.4600e-003	2.2000e-004	7.2000e-004	9.4000e-004	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	5.8000e-004	2.0000e-005	5.9000e-004	1.8000e-004	2.0000e-005	1.9000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**1.2500e-003**	**8.1000e-004**	**2.0500e-003**	**4.0000e-004**	**7.4000e-004**	**1.1300e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

3.4 Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3277	2.5480	1.6240	2.2600e-003		0.1896	0.1896		0.1788	0.1788	0.0000	206.2564	206.2564	0.0517	0.0000	207.3416
Total	**0.3277**	**2.5480**	**1.6240**	**2.2600e-003**		**0.1896**	**0.1896**		**0.1788**	**0.1788**	**0.0000**	**206.2564**	**206.2564**	**0.0517**	**0.0000**	**207.3416**

3.4 Construction - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5038	3.5365	5.2422	6.2800e-003	0.1703	0.0731	0.2434	0.0488	0.0672	0.1159	0.0000	579.2605	579.2605	6.3800e-003	0.0000	579.3944
Worker	0.3197	0.4008	3.9876	6.2500e-003	0.5179	4.6600e-003	0.5226	0.1377	4.2300e-003	0.1419	0.0000	499.4441	499.4441	0.0312	0.0000	500.0985
Total	**0.8235**	**3.9373**	**9.2298**	**0.0125**	**0.6882**	**0.0777**	**0.7659**	**0.1864**	**0.0714**	**0.2578**	**0.0000**	**1,078.7045**	**1,078.7045**	**0.0375**	**0.0000**	**1,079.4928**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0601	1.2261	1.5270	2.2600e-003		0.0606	0.0606		0.0606	0.0606	0.0000	206.2562	206.2562	0.0517	0.0000	207.3414
Total	**0.0601**	**1.2261**	**1.5270**	**2.2600e-003**		**0.0606**	**0.0606**		**0.0606**	**0.0606**	**0.0000**	**206.2562**	**206.2562**	**0.0517**	**0.0000**	**207.3414**

3.4 Construction - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5038	3.5365	5.2422	6.2800e-003	0.0724	0.0731	0.1455	0.0247	0.0672	0.0919	0.0000	579.2605	579.2605	6.3800e-003	0.0000	579.3944
Worker	0.3197	0.4008	3.9876	6.2500e-003	0.1593	4.6600e-003	0.1640	0.0496	4.2300e-003	0.0539	0.0000	499.4441	499.4441	0.0312	0.0000	500.0985
Total	**0.8235**	**3.9373**	**9.2298**	**0.0125**	**0.2317**	**0.0777**	**0.3094**	**0.0744**	**0.0714**	**0.1458**	**0.0000**	**1,078.7045**	**1,078.7045**	**0.0375**	**0.0000**	**1,079.4928**

3.4 Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4412	3.4878	2.2961	3.2200e-003		0.2566	0.2566		0.2416	0.2416	0.0000	292.1149	292.1149	0.0720	0.0000	293.6277
Total	**0.4412**	**3.4878**	**2.2961**	**3.2200e-003**		**0.2566**	**0.2566**		**0.2416**	**0.2416**	**0.0000**	**292.1149**	**292.1149**	**0.0720**	**0.0000**	**293.6277**

3.4 Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5826	4.3072	6.5033	8.9100e-003	0.2428	0.0778	0.3206	0.0696	0.0715	0.1411	0.0000	814.8853	814.8853	7.7500e-003	0.0000	815.0480
Worker	0.4001	0.5018	4.9766	8.9200e-003	0.7387	6.1400e-003	0.7448	0.1963	5.6000e-003	0.2019	0.0000	687.6592	687.6592	0.0399	0.0000	688.4971
Total	**0.9826**	**4.8090**	**11.4799**	**0.0178**	**0.9815**	**0.0839**	**1.0654**	**0.2659**	**0.0771**	**0.3430**	**0.0000**	**1,502.5444**	**1,502.5444**	**0.0477**	**0.0000**	**1,503.5451**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0857	1.7487	2.1779	3.2200e-003		0.0864	0.0864		0.0864	0.0864	0.0000	292.1145	292.1145	0.0720	0.0000	293.6273
Total	**0.0857**	**1.7487**	**2.1779**	**3.2200e-003**		**0.0864**	**0.0864**		**0.0864**	**0.0864**	**0.0000**	**292.1145**	**292.1145**	**0.0720**	**0.0000**	**293.6273**

3.4 Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5826	4.3072	6.5033	8.9100e-003	0.1032	0.0778	0.1810	0.0353	0.0715	0.1068	0.0000	814.8853	814.8853	7.7500e-003	0.0000	815.0480
Worker	0.4001	0.5018	4.9766	8.9200e-003	0.2272	6.1400e-003	0.2334	0.0708	5.6000e-003	0.0764	0.0000	687.6592	687.6592	0.0399	0.0000	688.4971
Total	**0.9826**	**4.8090**	**11.4799**	**0.0178**	**0.3304**	**0.0839**	**0.4144**	**0.1061**	**0.0771**	**0.1832**	**0.0000**	**1,502.5444**	**1,502.5444**	**0.0477**	**0.0000**	**1,503.5451**

3.4 Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1678	1.3539	0.9302	1.3200e-003		0.0975	0.0975		0.0918	0.0918	0.0000	118.8825	118.8825	0.0289	0.0000	119.4896
Total	**0.1678**	**1.3539**	**0.9302**	**1.3200e-003**		**0.0975**	**0.0975**		**0.0918**	**0.0918**	**0.0000**	**118.8825**	**118.8825**	**0.0289**	**0.0000**	**119.4896**

3.4 Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2098	1.5340	2.4478	3.6400e-003	0.0996	0.0268	0.1264	0.0285	0.0246	0.0532	0.0000	330.0396	330.0396	2.8800e-003	0.0000	330.1000
Worker	0.1444	0.1818	1.7949	3.6500e-003	0.3028	2.3700e-003	0.3052	0.0805	2.1700e-003	0.0827	0.0000	271.4091	271.4091	0.0148	0.0000	271.7190
Total	**0.3542**	**1.7158**	**4.2428**	**7.2900e-003**	**0.4024**	**0.0292**	**0.4316**	**0.1090**	**0.0268**	**0.1358**	**0.0000**	**601.4487**	**601.4487**	**0.0176**	**0.0000**	**601.8190**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0352	0.7169	0.8928	1.3200e-003		0.0354	0.0354		0.0354	0.0354	0.0000	118.8823	118.8823	0.0289	0.0000	119.4895
Total	**0.0352**	**0.7169**	**0.8928**	**1.3200e-003**		**0.0354**	**0.0354**		**0.0354**	**0.0354**	**0.0000**	**118.8823**	**118.8823**	**0.0289**	**0.0000**	**119.4895**

3.4 Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2098	1.5340	2.4478	3.6400e-003	0.0423	0.0268	0.0691	0.0145	0.0246	0.0391	0.0000	330.0396	330.0396	2.8800e-003	0.0000	330.1000
Worker	0.1444	0.1818	1.7949	3.6500e-003	0.0932	2.3700e-003	0.0955	0.0290	2.1700e-003	0.0312	0.0000	271.4091	271.4091	0.0148	0.0000	271.7190
Total	**0.3542**	**1.7158**	**4.2428**	**7.2900e-003**	**0.1355**	**0.0292**	**0.1646**	**0.0435**	**0.0268**	**0.0703**	**0.0000**	**601.4487**	**601.4487**	**0.0176**	**0.0000**	**601.8190**

3.5 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.7161					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0101	0.0652	0.0518	8.0000e-005		5.4100e-003	5.4100e-003		5.4100e-003	5.4100e-003	0.0000	7.0215	7.0215	8.3000e-004	0.0000	7.0388
Total	**0.7262**	**0.0652**	**0.0518**	**8.0000e-005**		**5.4100e-003**	**5.4100e-003**		**5.4100e-003**	**5.4100e-003**	**0.0000**	**7.0215**	**7.0215**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0149	0.0187	0.1851	3.8000e-004	0.0312	2.4000e-004	0.0315	8.3000e-003	2.2000e-004	8.5200e-003	0.0000	27.9807	27.9807	1.5200e-003	0.0000	28.0126
Total	**0.0149**	**0.0187**	**0.1851**	**3.8000e-004**	**0.0312**	**2.4000e-004**	**0.0315**	**8.3000e-003**	**2.2000e-004**	**8.5200e-003**	**0.0000**	**27.9807**	**27.9807**	**1.5200e-003**	**0.0000**	**28.0126**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.7161					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	3.5400e-003	0.0504	8.0000e-005		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	7.0214	7.0214	8.3000e-004	0.0000	7.0388
Total	**0.7169**	**3.5400e-003**	**0.0504**	**8.0000e-005**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**7.0214**	**7.0214**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0149	0.0187	0.1851	3.8000e-004	9.6000e-003	2.4000e-004	9.8500e-003	2.9900e-003	2.2000e-004	3.2200e-003	0.0000	27.9807	27.9807	1.5200e-003	0.0000	28.0126
Total	**0.0149**	**0.0187**	**0.1851**	**3.8000e-004**	**9.6000e-003**	**2.4000e-004**	**9.8500e-003**	**2.9900e-003**	**2.2000e-004**	**3.2200e-003**	**0.0000**	**27.9807**	**27.9807**	**1.5200e-003**	**0.0000**	**28.0126**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Density

Increase Diversity

Improve Walkability Design

Improve Destination Accessibility

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

Implement NEV Network

Limit Parking Supply

Increase Transit Frequency

Implement Trip Reduction Program

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	9.1180	17.6528	86.4037	0.0760	3.9631	0.1994	4.1625	1.0646	0.1829	1.2475	0.0000	6,170.0375	6,170.0375	0.2503	0.0000	6,175.2934
Unmitigated	10.2632	28.5244	107.3436	0.1431	7.8978	0.3690	8.2668	2.1216	0.3389	2.4604	0.0000	11,677.1193	11,677.1193	0.4236	0.0000	11,686.0156

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	11,846.96	11,846.96	11846.96	20,771,323	10,422,974
Total	11,846.96	11,846.96	11,846.96	20,771,323	10,422,974

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
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Regional Shopping Center	9.50	7.30	7.30	16.30	64.70	19.00	54	35	11

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.413014	0.062673	0.156172	0.176687	0.051255	0.007895	0.018867	0.100331	0.001803	0.001598	0.006448	0.000946	0.002310

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: Y

5.1 Mitigation Measures Energy

Install High Efficiency Lighting

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	713.5807	713.5807	0.0328	6.7900e-003	716.3733
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	1,290.1785	1,290.1785	0.0593	0.0123	1,295.2276
NaturalGas Mitigated	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	97.5328	97.5328	1.8700e-003	1.7900e-003	98.1263
NaturalGas Unmitigated	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	97.5328	97.5328	1.8700e-003	1.7900e-003	98.1263

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					
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.8277e+006	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	97.5328	97.5328	1.8700e-003	1.7900e-003	98.1263
Total		**9.8600e-003**	**0.0896**	**0.0753**	**5.4000e-004**		**6.8100e-003**	**6.8100e-003**		**6.8100e-003**	**6.8100e-003**	**0.0000**	**97.5328**	**97.5328**	**1.8700e-003**	**1.7900e-003**	**98.1263**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Regional Shopping Center	1.8277e+006	9.8600e-003	0.0896	0.0753	5.4000e-004		6.8100e-003	6.8100e-003		6.8100e-003	6.8100e-003	0.0000	97.5328	97.5328	1.8700e-003	1.7900e-003	98.1263
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**9.8600e-003**	**0.0896**	**0.0753**	**5.4000e-004**		**6.8100e-003**	**6.8100e-003**		**6.8100e-003**	**6.8100e-003**	**0.0000**	**97.5328**	**97.5328**	**1.8700e-003**	**1.7900e-003**	**98.1263**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Parking Lot	1.30539e+006	373.5587	0.0172	3.5500e-003	375.0206
Regional Shopping Center	3.2031e+006	916.6197	0.0421	8.7200e-003	920.2069
Total		**1,290.1785**	**0.0593**	**0.0123**	**1,295.2276**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Parking Lot	352455	100.8609	4.6400e-003	9.6000e-004	101.2556
Regional Shopping Center	2.14113e+006	612.7198	0.0282	5.8300e-003	615.1177
Total		**713.5807**	**0.0328**	**6.7900e-003**	**716.3733**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

No Hearths Installed

Use Low VOC Cleaning Supplies

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	6.3892	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331
Unmitigated	7.0070	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1790					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	6.8264					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6100e-003	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331
Total	**7.0070**	**1.6000e-004**	**0.0165**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0312**	**0.0312**	**9.0000e-005**	**0.0000**	**0.0331**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0716					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	6.3160					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6100e-003	1.6000e-004	0.0165	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0312	0.0312	9.0000e-005	0.0000	0.0331
Total	**6.3892**	**1.6000e-004**	**0.0165**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0312**	**0.0312**	**9.0000e-005**	**0.0000**	**0.0331**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Turf Reduction

Use Water Efficient Irrigation System

Use Water Efficient Landscaping

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	36.8372	0.5122	0.0124	51.4256
Unmitigated	48.5803	0.6404	0.0155	66.8258

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	19.5922 / 12.0081	48.5803	0.6404	0.0155	66.8258
Total		**48.5803**	**0.6404**	**0.0155**	**66.8258**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	15.6737 / 9.60649	36.8372	0.5122	0.0124	51.4256
Total		**36.8372**	**0.5122**	**0.0124**	**51.4256**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	19.7318	1.1661	0.0000	44.2203
Unmitigated	56.3767	3.3318	0.0000	126.3438

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	277.73	56.3767	3.3318	0.0000	126.3438
Total		**56.3767**	**3.3318**	**0.0000**	**126.3438**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	97.2055	19.7318	1.1661	0.0000	44.2203
Total		**19.7318**	**1.1661**	**0.0000**	**44.2203**

9.0 Operational Offroad

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

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	212.4000	0.0000	0.0000	212.4000

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Others	44.64 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Aspen	0	0.0000	0.0000	0.0000	0.0000
Hardwood Maple	0	0.0000	0.0000	0.0000	0.0000
Juniper	0	0.0000	0.0000	0.0000	0.0000
Miscellaneous	300	212.4000	0.0000	0.0000	212.4000
Mixed Hardwood	0	0.0000	0.0000	0.0000	0.0000
Soft Maple	0	0.0000	0.0000	0.0000	0.0000
Total		**212.4000**	**0.0000**	**0.0000**	**212.4000**

Grapevine-3Alternative3.19.14

San Joaquin Valley Unified APCD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	1,483.39	1000sqft	34.05	1,483,395.00	0
Gasoline/Service Station	24.00	Pump	0.08	3,388.20	0
Regional Shopping Center	249.50	1000sqft	5.73	249,500.00	0
High Turnover (Sit Down Restaurant)	3.00	1000sqft	0.07	3,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	7			**Operational Year**	2016
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Outparcel
Gas Station 24 bay
3000 sqft restaurant

Construction Phase - DURATION
Flat Project Site

Off-road Equipment - Duration 1.5 months

Off-road Equipment - Crane runs approximately 4 hours/day

Off-road Equipment - Duration: 1.8 months

Off-road Equipment - Detention Basin equipment

Off-road Equipment - Duration 3.6 months

Trips and VMT - Check
1.6 miles round trip from center of project site to detention basin entrance.

On-road Fugitive Dust - Mitigation Measures
Mean Vehicle Speed= 5mph

Grading - 9000 cy imported to project site as fill material.
Vehicle Speed= 5 mph(mitigation measure)
Total acres=project site size

Architectural Coating - Low VOC paint= < 50 g/L

Vehicle Trips - TIAR rate based off of CalEEMod Appendix A page 20.

Road Dust - mitigation
5 mph vehicle speed

Area Coating - Low VOC paint= <50 g/L

Land Use Change - Unused ag land= Others
44.64 acres to completely paved

Sequestration - 300 trees based on adding a tree at the end of each parking row.
Native trees taht do not require much water. See reference.

Construction Off-road Equipment Mitigation - All equipment Tier 3.
Moisture Content on average of 10%-WRAP Handbook
Vehicle Speed= 5 mph
Water 4 times/day=74% reduction WRAP Table 3-7

Mobile Land Use Mitigation - 617 jobs/44.64=13.82
Inter./sq. mile: 640 acres/sq. mi.
project size =14.33 acres/sq mi.
*9 interesections= 129 inter/sq.m.
75 % of streets= dover, parkway belmont
50 % of streets= 6/9= 66%(conservative w/ 50)
18% reduction in parking

Mobile Commute Mitigation - Implement Trip Reduction Program.
50% eligible. Required

Area Mitigation - LOW VOC paint =<50 g/L

Energy Mitigation - High efficiency LED lighting
Water Mitigation - 20% reduction per CA regulation.
Install Low Flow everything.

Waste Mitigation - 60% waste reduction

Water And Wastewater -

Solid Waste -

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	50.00
tblArchitecturalCoating	EF_Nonresidential_Interior	150.00	50.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	0.00
tblArchitecturalCoating	EF_Residential_Interior	150.00	0.00
tblAreaCoating	Area_EF_Nonresidential_Exterior	150	50
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	150	50
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	80
tblConstDustMitigation	WaterExposedAreaPM10PercentReduction	61	74
tblConstDustMitigation	WaterExposedAreaPM25PercentReduction	61	74
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final

tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstructionPhase	NumDays	740.00	551.00
tblConstructionPhase	NumDays	75.00	36.00
tblConstructionPhase	NumDays	75.00	36.00
tblConstructionPhase	PhaseEndDate	5/31/2016	5/30/2016
tblConstructionPhase	PhaseEndDate	6/10/2014	4/21/2014
tblConstructionPhase	PhaseStartDate	4/22/2014	4/21/2014
tblConstructionPhase	PhaseStartDate	4/22/2014	3/1/2014
tblGrading	MaterialExported	0.00	24,000.00
tblGrading	MaterialImported	0.00	9,000.00
tblLandUse	LandUseSquareFeet	1,483,390.00	1,483,395.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	7.00	4.00
tblProjectCharacteristics	OperationalYear	2014	2016
tblSequestration	NumberOfNewTrees	0.00	300.00
tblTripsAndVMT	HaulingTripLength	20.00	1.60
tblVehicleTrips	ST_TR	49.97	44.79

tblVehicleTrips	SU_TR	25.24	44.79
tblVehicleTrips	WD_TR	42.94	44.79

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.3905	9.0643	12.8374	0.0170	0.9942	0.3836	1.3779	0.3173	0.3572	0.6744	0.0000	1,496.7989	1,496.7989	0.1384	0.0000	1,499.7049
2015	1.4195	8.2789	13.7251	0.0210	0.9765	0.3402	1.3167	0.2645	0.3185	0.5830	0.0000	1,787.9249	1,787.9249	0.1194	0.0000	1,790.4331
2016	1.2363	3.1472	5.3898	9.0400e-003	0.4313	0.1322	0.5635	0.1167	0.1241	0.2408	0.0000	752.4489	752.4489	0.0488	0.0000	753.4735
Total	**4.0463**	**20.4903**	**31.9523**	**0.0470**	**2.4020**	**0.8560**	**3.2581**	**0.6985**	**0.7997**	**1.4982**	**0.0000**	**4,037.1727**	**4,037.1727**	**0.3066**	**0.0000**	**4,043.6115**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.9696	6.3313	12.3009	0.0170	0.3128	0.1797	0.4925	0.1090	0.1730	0.2820	0.0000	1,496.7985	1,496.7985	0.1384	0.0000	1,499.7044
2015	1.0641	6.5399	13.6069	0.0210	0.3288	0.1700	0.4988	0.1055	0.1632	0.2687	0.0000	1,787.9246	1,787.9246	0.1194	0.0000	1,790.4328
2016	1.0944	2.4484	5.3510	9.0400e-003	0.1443	0.0648	0.2092	0.0462	0.0625	0.1087	0.0000	752.4487	752.4487	0.0488	0.0000	753.4734
Total	**3.1280**	**15.3196**	**31.2589**	**0.0470**	**0.7859**	**0.4145**	**1.2004**	**0.2608**	**0.3986**	**0.6594**	**0.0000**	**4,037.1718**	**4,037.1718**	**0.3066**	**0.0000**	**4,043.6106**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**22.70**	**25.23**	**2.17**	**0.00**	**67.28**	**51.58**	**63.16**	**62.66**	**50.16**	**55.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.9671	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333
Energy	9.6500e-003	0.0877	0.0737	5.3000e-004		6.6700e-003	6.6700e-003		6.6700e-003	6.6700e-003	0.0000	1,336.3597	1,336.3597	0.0589	0.0136	1,341.7971
Mobile	12.5567	31.4819	127.3487	0.1524	8.3058	0.3944	8.7002	2.2311	0.3621	2.5932	0.0000	12,418.3015	12,418.3015	0.4623	0.0000	12,428.0092
Waste						0.0000	0.0000		0.0000	0.0000	56.4071	0.0000	56.4071	3.3336	0.0000	126.4120
Water						0.0000	0.0000		0.0000	0.0000	5.9875	40.8093	46.7968	0.6169	0.0149	64.3725
Total	**19.5335**	**31.5698**	**127.4390**	**0.1529**	**8.3058**	**0.4011**	**8.7069**	**2.2311**	**0.3688**	**2.6000**	**62.3946**	**13,795.5020**	**13,857.8966**	**4.4717**	**0.0285**	**13,960.6240**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.3556	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333
Energy	9.6500e-003	0.0877	0.0737	5.3000e-004		6.6700e-003	6.6700e-003		6.6700e-003	6.6700e-003	0.0000	776.3522	776.3522	0.0331	8.2300e-003	779.5980
Mobile	11.3703	20.2194	105.6559	0.0829	4.2296	0.2187	4.4483	1.1362	0.2005	1.3367	0.0000	6,713.2216	6,713.2216	0.2827	0.0000	6,719.1581
Waste						0.0000	0.0000		0.0000	0.0000	19.7425	0.0000	19.7425	1.1668	0.0000	44.2442
Water						0.0000	0.0000		0.0000	0.0000	4.7900	30.6948	35.4848	0.4934	0.0119	49.5377
Total	**17.7356**	**20.3073**	**105.7462**	**0.0834**	**4.2296**	**0.2254**	**4.4550**	**1.1362**	**0.2073**	**1.3434**	**24.5325**	**7,520.3001**	**7,544.8326**	**1.9761**	**0.0201**	**7,592.5713**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**9.20**	**35.67**	**17.02**	**45.47**	**49.08**	**43.80**	**48.83**	**49.08**	**43.80**	**48.33**	**60.68**	**45.49**	**45.56**	**55.81**	**29.23**	**45.61**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	212.4000
Vegetation Land Change	0.0000
Total	**212.4000**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Grading	Grading	3/1/2014	4/21/2014	5	36	CE
2	Detention Basin Expansion	Grading	3/1/2014	4/21/2014	5	36	
3	Construction	Building Construction	4/21/2014	5/30/2016	5	551	DMP
4	Architectural Coating	Architectural Coating	5/31/2016	8/15/2016	5	55	DMP

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 90

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 447,250; Non-Residential Outdoor: 149,083 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Detention Basin Expansion	Excavators	1	8.00	162	0.38
Detention Basin Expansion	Graders	1	8.00	174	0.41
Detention Basin Expansion	Rubber Tired Dozers	1	8.00	255	0.40
Detention Basin Expansion	Scrapers	1	8.00	361	0.48
Detention Basin Expansion	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Construction	Cranes	1	4.00	226	0.29
Construction	Forklifts	3	8.00	89	0.20
Construction	Generator Sets	1	8.00	84	0.74
Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Grading	7	18.00	0.00	1,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Detention Basin Expansion	5	13.00	0.00	2,373.00	10.80	7.30	1.60	LD_Mix	HDT_Mix	HHDT
Construction	9	704.00	285.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	141.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1568	0.0000	0.1568	0.0648	0.0000	0.0648	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1156	1.3620	0.8669	1.0200e-003		0.0654	0.0654		0.0601	0.0601	0.0000	97.8716	97.8716	0.0289	0.0000	98.4790
Total	**0.1156**	**1.3620**	**0.8669**	**1.0200e-003**	**0.1568**	**0.0654**	**0.2221**	**0.0648**	**0.0601**	**0.1250**	**0.0000**	**97.8716**	**97.8716**	**0.0289**	**0.0000**	**98.4790**

3.2 Grading - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	9.6200e-003	3.8900e-003	0.0135	2.6500e-003	3.5800e-003	6.2300e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**0.0122**	**3.9100e-003**	**0.0161**	**3.3400e-003**	**3.6000e-003**	**6.9400e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0408	0.0000	0.0408	0.0169	0.0000	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.5326	0.6107	1.0200e-003		0.0220	0.0220		0.0220	0.0220	0.0000	97.8715	97.8715	0.0289	0.0000	98.4789
Total	**0.0265**	**0.5326**	**0.6107**	**1.0200e-003**	**0.0408**	**0.0220**	**0.0628**	**0.0169**	**0.0220**	**0.0389**	**0.0000**	**97.8715**	**97.8715**	**0.0289**	**0.0000**	**98.4789**

3.2 Grading - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	3.8600e-003	3.8900e-003	7.7500e-003	1.2300e-003	3.5800e-003	4.8100e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	8.0000e-004	2.0000e-005	8.2000e-004	2.5000e-004	2.0000e-005	2.7000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**4.6600e-003**	**3.9100e-003**	**8.5700e-003**	**1.4800e-003**	**3.6000e-003**	**5.0800e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1370	0.0000	0.1370	0.0627	0.0000	0.0627	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0827	0.9555	0.6088	6.9000e-004		0.0465	0.0465		0.0428	0.0428	0.0000	66.6469	66.6469	0.0197	0.0000	67.0605
Total	**0.0827**	**0.9555**	**0.6088**	**6.9000e-004**	**0.1370**	**0.0465**	**0.1836**	**0.0627**	**0.0428**	**0.1055**	**0.0000**	**66.6469**	**66.6469**	**0.0197**	**0.0000**	**67.0605**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	1.6500e-003	7.9000e-004	2.4300e-003	4.6000e-004	7.2000e-004	1.1800e-003	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	1.8700e-003	2.0000e-005	1.8900e-003	5.0000e-004	2.0000e-005	5.1000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**3.5200e-003**	**8.1000e-004**	**4.3200e-003**	**9.6000e-004**	**7.4000e-004**	**1.6900e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0356	0.0000	0.0356	0.0163	0.0000	0.0163	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0185	0.3738	0.4255	6.9000e-004		0.0150	0.0150		0.0150	0.0150	0.0000	66.6468	66.6468	0.0197	0.0000	67.0604
Total	**0.0185**	**0.3738**	**0.4255**	**6.9000e-004**	**0.0356**	**0.0150**	**0.0506**	**0.0163**	**0.0150**	**0.0313**	**0.0000**	**66.6468**	**66.6468**	**0.0197**	**0.0000**	**67.0604**

3.3 Detention Basin Expansion - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	6.7000e-004	7.9000e-004	1.4600e-003	2.2000e-004	7.2000e-004	9.4000e-004	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	5.8000e-004	2.0000e-005	5.9000e-004	1.8000e-004	2.0000e-005	1.9000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**1.2500e-003**	**8.1000e-004**	**2.0500e-003**	**4.0000e-004**	**7.4000e-004**	**1.1300e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

3.4 Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3277	2.5480	1.6240	2.2600e-003		0.1896	0.1896		0.1788	0.1788	0.0000	206.2564	206.2564	0.0517	0.0000	207.3416
Total	**0.3277**	**2.5480**	**1.6240**	**2.2600e-003**		**0.1896**	**0.1896**		**0.1788**	**0.1788**	**0.0000**	**206.2564**	**206.2564**	**0.0517**	**0.0000**	**207.3416**

3.4 Construction - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5020	3.5242	5.2239	6.2500e-003	0.1697	0.0728	0.2425	0.0486	0.0669	0.1155	0.0000	577.2351	577.2351	6.3500e-003	0.0000	577.3685
Worker	0.3179	0.3985	3.9651	6.2100e-003	0.5150	4.6300e-003	0.5196	0.1369	4.2100e-003	0.1411	0.0000	496.6223	496.6223	0.0310	0.0000	497.2730
Total	**0.8199**	**3.9227**	**9.1890**	**0.0125**	**0.6847**	**0.0775**	**0.7621**	**0.1855**	**0.0711**	**0.2566**	**0.0000**	**1,073.8574**	**1,073.8574**	**0.0373**	**0.0000**	**1,074.6415**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0601	1.2261	1.5270	2.2600e-003		0.0606	0.0606		0.0606	0.0606	0.0000	206.2562	206.2562	0.0517	0.0000	207.3414
Total	**0.0601**	**1.2261**	**1.5270**	**2.2600e-003**		**0.0606**	**0.0606**		**0.0606**	**0.0606**	**0.0000**	**206.2562**	**206.2562**	**0.0517**	**0.0000**	**207.3414**

3.4 Construction - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5020	3.5242	5.2239	6.2500e-003	0.0721	0.0728	0.1450	0.0247	0.0669	0.0916	0.0000	577.2351	577.2351	6.3500e-003	0.0000	577.3685
Worker	0.3179	0.3985	3.9651	6.2100e-003	0.1584	4.6300e-003	0.1631	0.0494	4.2100e-003	0.0536	0.0000	496.6223	496.6223	0.0310	0.0000	497.2730
Total	**0.8199**	**3.9227**	**9.1890**	**0.0125**	**0.2305**	**0.0775**	**0.3080**	**0.0740**	**0.0711**	**0.1452**	**0.0000**	**1,073.8574**	**1,073.8574**	**0.0373**	**0.0000**	**1,074.6415**

3.4 Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4412	3.4878	2.2961	3.2200e-003		0.2566	0.2566		0.2416	0.2416	0.0000	292.1149	292.1149	0.0720	0.0000	293.6277
Total	**0.4412**	**3.4878**	**2.2961**	**3.2200e-003**		**0.2566**	**0.2566**		**0.2416**	**0.2416**	**0.0000**	**292.1149**	**292.1149**	**0.0720**	**0.0000**	**293.6277**

3.4 Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5805	4.2921	6.4805	8.8700e-003	0.2420	0.0775	0.3195	0.0693	0.0713	0.1406	0.0000	812.0360	812.0360	7.7200e-003	0.0000	812.1982
Worker	0.3978	0.4990	4.9485	8.8700e-003	0.7345	6.1000e-003	0.7406	0.1952	5.5700e-003	0.2008	0.0000	683.7741	683.7741	0.0397	0.0000	684.6073
Total	**0.9783**	**4.7911**	**11.4290**	**0.0177**	**0.9765**	**0.0836**	**1.0601**	**0.2645**	**0.0768**	**0.3414**	**0.0000**	**1,495.8101**	**1,495.8101**	**0.0474**	**0.0000**	**1,496.8054**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0857	1.7487	2.1779	3.2200e-003		0.0864	0.0864		0.0864	0.0864	0.0000	292.1145	292.1145	0.0720	0.0000	293.6273
Total	**0.0857**	**1.7487**	**2.1779**	**3.2200e-003**		**0.0864**	**0.0864**		**0.0864**	**0.0864**	**0.0000**	**292.1145**	**292.1145**	**0.0720**	**0.0000**	**293.6273**

3.4 Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.5805	4.2921	6.4805	8.8700e-003	0.1028	0.0775	0.1804	0.0352	0.0713	0.1064	0.0000	812.0360	812.0360	7.7200e-003	0.0000	812.1982
Worker	0.3978	0.4990	4.9485	8.8700e-003	0.2259	6.1000e-003	0.2320	0.0704	5.5700e-003	0.0760	0.0000	683.7741	683.7741	0.0397	0.0000	684.6073
Total	**0.9783**	**4.7911**	**11.4290**	**0.0177**	**0.3288**	**0.0836**	**0.4124**	**0.1055**	**0.0768**	**0.1824**	**0.0000**	**1,495.8101**	**1,495.8101**	**0.0474**	**0.0000**	**1,496.8054**

3.4 Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1678	1.3539	0.9302	1.3200e-003		0.0975	0.0975		0.0918	0.0918	0.0000	118.8825	118.8825	0.0289	0.0000	119.4896
Total	**0.1678**	**1.3539**	**0.9302**	**1.3200e-003**		**0.0975**	**0.0975**		**0.0918**	**0.0918**	**0.0000**	**118.8825**	**118.8825**	**0.0289**	**0.0000**	**119.4896**

3.4 Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2091	1.5286	2.4393	3.6300e-003	0.0992	0.0267	0.1259	0.0284	0.0246	0.0530	0.0000	328.8856	328.8856	2.8700e-003	0.0000	328.9458
Worker	0.1436	0.1808	1.7848	3.6300e-003	0.3011	2.3600e-003	0.3035	0.0800	2.1600e-003	0.0822	0.0000	269.8757	269.8757	0.0147	0.0000	270.1838
Total	**0.3526**	**1.7094**	**4.2241**	**7.2600e-003**	**0.4003**	**0.0291**	**0.4294**	**0.1085**	**0.0267**	**0.1352**	**0.0000**	**598.7613**	**598.7613**	**0.0175**	**0.0000**	**599.1297**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0352	0.7169	0.8928	1.3200e-003		0.0354	0.0354		0.0354	0.0354	0.0000	118.8823	118.8823	0.0289	0.0000	119.4895
Total	**0.0352**	**0.7169**	**0.8928**	**1.3200e-003**		**0.0354**	**0.0354**		**0.0354**	**0.0354**	**0.0000**	**118.8823**	**118.8823**	**0.0289**	**0.0000**	**119.4895**

3.4 Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.2091	1.5286	2.4393	3.6300e-003	0.0422	0.0267	0.0689	0.0144	0.0246	0.0390	0.0000	328.8856	328.8856	2.8700e-003	0.0000	328.9458
Worker	0.1436	0.1808	1.7848	3.6300e-003	0.0926	2.3600e-003	0.0950	0.0289	2.1600e-003	0.0310	0.0000	269.8757	269.8757	0.0147	0.0000	270.1838
Total	**0.3526**	**1.7094**	**4.2241**	**7.2600e-003**	**0.1348**	**0.0291**	**0.1639**	**0.0433**	**0.0267**	**0.0700**	**0.0000**	**598.7613**	**598.7613**	**0.0175**	**0.0000**	**599.1297**

3.5 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.6910					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0101	0.0652	0.0518	8.0000e-005		5.4100e-003	5.4100e-003		5.4100e-003	5.4100e-003	0.0000	7.0215	7.0215	8.3000e-004	0.0000	7.0388
Total	**0.7011**	**0.0652**	**0.0518**	**8.0000e-005**		**5.4100e-003**	**5.4100e-003**		**5.4100e-003**	**5.4100e-003**	**0.0000**	**7.0215**	**7.0215**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0148	0.0186	0.1837	3.7000e-004	0.0310	2.4000e-004	0.0312	8.2400e-003	2.2000e-004	8.4600e-003	0.0000	27.7836	27.7836	1.5100e-003	0.0000	27.8154
Total	**0.0148**	**0.0186**	**0.1837**	**3.7000e-004**	**0.0310**	**2.4000e-004**	**0.0312**	**8.2400e-003**	**2.2000e-004**	**8.4600e-003**	**0.0000**	**27.7836**	**27.7836**	**1.5100e-003**	**0.0000**	**27.8154**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.6910					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	3.5400e-003	0.0504	8.0000e-005		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	7.0214	7.0214	8.3000e-004	0.0000	7.0388
Total	**0.6918**	**3.5400e-003**	**0.0504**	**8.0000e-005**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**7.0214**	**7.0214**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0148	0.0186	0.1837	3.7000e-004	9.5400e-003	2.4000e-004	9.7800e-003	2.9700e-003	2.2000e-004	3.1900e-003	0.0000	27.7836	27.7836	1.5100e-003	0.0000	27.8154
Total	**0.0148**	**0.0186**	**0.1837**	**3.7000e-004**	**9.5400e-003**	**2.4000e-004**	**9.7800e-003**	**2.9700e-003**	**2.2000e-004**	**3.1900e-003**	**0.0000**	**27.7836**	**27.7836**	**1.5100e-003**	**0.0000**	**27.8154**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Density

Increase Diversity

Improve Walkability Design

Improve Destination Accessibility

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

Implement NEV Network

Limit Parking Supply

Increase Transit Frequency

Implement Trip Reduction Program

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	11.3703	20.2194	105.6559	0.0829	4.2296	0.2187	4.4483	1.1362	0.2005	1.3367	0.0000	6,713.2216	6,713.2216	0.2827	0.0000	6,719.1581
Unmitigated	12.5567	31.4819	127.3487	0.1524	8.3058	0.3944	8.7002	2.2311	0.3621	2.5932	0.0000	12,418.3015	12,418.3015	0.4623	0.0000	12,428.0092

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Gasoline/Service Station	3,906.72	3,906.72	3906.72	2,250,928	1,146,775
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	11,175.11	11,175.11	11175.11	19,593,366	9,977,113
Total	15,081.83	15,081.83	15,081.83	21,844,294	11,123,887

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
Gasoline/Service Station	9.50	7.30	7.30	2.00	79.00	19.00	14	27	59
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Regional Shopping Center	9.50	7.30	7.30	16.30	64.70	19.00	54	35	11

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.413014	0.062673	0.156172	0.176687	0.051255	0.007895	0.018867	0.100331	0.001803	0.001598	0.006448	0.000946	0.002310

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: Y

5.1 Mitigation Measures Energy

Install High Efficiency Lighting

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	680.8357	680.8357	0.0313	6.4800e-003	683.5002
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	1,240.8432	1,240.8432	0.0570	0.0118	1,245.6993
NaturalGas Mitigated	9.6500e-003	0.0877	0.0737	5.3000e-004		6.6700e-003	6.6700e-003		6.6700e-003	6.6700e-003	0.0000	95.5165	95.5165	1.8300e-003	1.7500e-003	96.0978
NaturalGas Unmitigated	9.6500e-003	0.0877	0.0737	5.3000e-004		6.6700e-003	6.6700e-003		6.6700e-003	6.6700e-003	0.0000	95.5165	95.5165	1.8300e-003	1.7500e-003	96.0978

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					
Gasoline/Service Station	65866.6	3.6000e-004	3.2300e-003	2.7100e-003	2.0000e-005		2.5000e-004	2.5000e-004		2.5000e-004	2.5000e-004	0.0000	3.5149	3.5149	7.0000e-005	6.0000e-005	3.5363
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.72405e+006	9.3000e-003	0.0845	0.0710	5.1000e-004		6.4200e-003	6.4200e-003		6.4200e-003	6.4200e-003	0.0000	92.0016	92.0016	1.7600e-003	1.6900e-003	92.5615
Total		**9.6600e-003**	**0.0877**	**0.0737**	**5.3000e-004**		**6.6700e-003**	**6.6700e-003**		**6.6700e-003**	**6.6700e-003**	**0.0000**	**95.5165**	**95.5165**	**1.8300e-003**	**1.7500e-003**	**96.0978**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.72405e+006	9.3000e-003	0.0845	0.0710	5.1000e-004		6.4200e-003	6.4200e-003		6.4200e-003	6.4200e-003	0.0000	92.0016	92.0016	1.7600e-003	1.6900e-003	92.5615
Gasoline/Service Station	65866.6	3.6000e-004	3.2300e-003	2.7100e-003	2.0000e-005		2.5000e-004	2.5000e-004		2.5000e-004	2.5000e-004	0.0000	3.5149	3.5149	7.0000e-005	6.0000e-005	3.5363
Total		**9.6600e-003**	**0.0877**	**0.0737**	**5.3000e-004**		**6.6700e-003**	**6.6700e-003**		**6.6700e-003**	**6.6700e-003**	**0.0000**	**95.5165**	**95.5165**	**1.8300e-003**	**1.7500e-003**	**96.0978**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Gasoline/Service Station	9249.79	2.6470	1.2000e-004	3.0000e-005	2.6573
Parking Lot	1.30539e+006	373.5587	0.0172	3.5500e-003	375.0206
Regional Shopping Center	3.02145e+006	864.6375	0.0397	8.2200e-003	868.0213
Total		**1,240.8432**	**0.0570**	**0.0118**	**1,245.6993**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Gasoline/Service Station	6999	2.0029	9.0000e-005	2.0000e-005	2.0107
Parking Lot	352455	100.8609	4.6400e-003	9.6000e-004	101.2556
Regional Shopping Center	2.0197e+006	577.9720	0.0266	5.5000e-003	580.2339
Total		**680.8357**	**0.0313**	**6.4800e-003**	**683.5002**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

No Hearths Installed

Use Low VOC Cleaning Supplies

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	6.3556	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333
Unmitigated	6.9671	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1728					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	6.7928					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6200e-003	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333
Total	**6.9671**	**1.6000e-004**	**0.0166**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0315**	**0.0315**	**9.0000e-005**	**0.0000**	**0.0333**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0691					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	6.2849					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.6200e-003	1.6000e-004	0.0166	0.0000		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.0315	0.0315	9.0000e-005	0.0000	0.0333
Total	**6.3556**	**1.6000e-004**	**0.0166**	**0.0000**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**0.0315**	**0.0315**	**9.0000e-005**	**0.0000**	**0.0333**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Turf Reduction

Use Water Efficient Irrigation System

Use Water Efficient Landscaping

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	35.4848	0.4934	0.0119	49.5377
Unmitigated	46.7968	0.6169	0.0149	64.3725

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Gasoline/Service Station	0.391816 / 0.240145	0.9715	0.0128	3.1000e-004	1.3364
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	18.4811 / 11.3271	45.8253	0.6040	0.0146	63.0361
Total		**46.7968**	**0.6169**	**0.0149**	**64.3725**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Gasoline/Service Station	0.313453 / 0.192116	0.7367	0.0102	2.5000e-004	1.0284
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	14.7849 / 9.0617	34.7481	0.4832	0.0117	48.5092
Total		**35.4848**	**0.4934**	**0.0119**	**49.5377**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	19.7425	1.1668	0.0000	44.2442
Unmitigated	56.4071	3.3336	0.0000	126.4120

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Gasoline/Service Station	15.9	3.2276	0.1907	0.0000	7.2332
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	261.98	53.1796	3.1428	0.0000	119.1789
Total		**56.4071**	**3.3336**	**0.0000**	**126.4120**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Gasoline/Service Station	5.565	1.1296	0.0668	0.0000	2.5316
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	91.693	18.6129	1.1000	0.0000	41.7126
Total		**19.7425**	**1.1668**	**0.0000**	**44.2442**

9.0 Operational Offroad

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

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	212.4000	0.0000	0.0000	212.4000

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Others	44.64 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Aspen	0	0.0000	0.0000	0.0000	0.0000
Hardwood Maple	0	0.0000	0.0000	0.0000	0.0000
Juniper	0	0.0000	0.0000	0.0000	0.0000
Miscellaneous	300	212.4000	0.0000	0.0000	212.4000
Mixed Hardwood	0	0.0000	0.0000	0.0000	0.0000
Soft Maple	0	0.0000	0.0000	0.0000	0.0000
Total		**212.4000**	**0.0000**	**0.0000**	**212.4000**

Grapevine-4Alternative3.19.14

San Joaquin Valley Unified APCD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Light Industry	200.00	1000sqft	4.59	200,000.00	0
Manufacturing	50.00	1000sqft	1.15	50,000.00	0
Parking Lot	600.00	Space	5.40	240,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	45
Climate Zone	7			**Operational Year**	2016
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Outparcel
ALternative Analysis

Construction Phase - DURATIONS
Flat Project Site

Off-road Equipment - Duration 1.5 months

Off-road Equipment - Crane runs approximately 4 hours/day

Off-road Equipment - Duration: 1.8 months

Off-road Equipment - Detention Basin equipment

Off-road Equipment - Duration 3.6 months
Trips and VMT - Check
1.6 miles round trip from center of project site to detention basin entrance.

On-road Fugitive Dust - Mitigation Measures
Mean Vehicle Speed= 5mph

Grading - 9000 cy imported to project site as fill material.
Vehicle Speed= 5 mph(mitigation measure)
Total acres=project site size

Architectural Coating - Low VOC paint= < 50 g/L

Vehicle Trips - TIAR rate based off of CalEEMod Appendix A page 20.

Road Dust - mitigation
5 mph vehicle speed

Area Coating - Low VOC paint= <50 g/L

Land Use Change - Unused ag land= Others
44.64 acres to completely paved

Sequestration -

Construction Off-road Equipment Mitigation - All equipment Tier 3.
Moisture Content on average of 10%-WRAP Handbook
Vehicle Speed= 5 mph
Water 4 times/day=74% reduction WRAP Table 3-7

Mobile Land Use Mitigation - 617 jobs/44.64=13.82
Inter./sq. mile: 640 acres/sq. mi.
project size =14.33 acres/sq mi.
*9 interesections= 129 inter/sq.m.
75 % of streets= dover, parkway belmont
50 % of streets= 6/9= 66%(conservative w/ 50)
18% reduction in parking

Mobile Commute Mitigation - Implement Trip Reduction Program.
50% eligible. Required

Area Mitigation - LOW VOC paint =<50 g/L

Energy Mitigation - High efficiency LED lighting

Water Mitigation - 20% reduction per CA regulation.
Install Low Flow everything.

Waste Mitigation - 60% waste reduction

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	EF_Nonresidential_Exterior	150.00	50.00
tblArchitecturalCoating	EF_Nonresidential_Interior	150.00	50.00
tblArchitecturalCoating	EF_Residential_Exterior	150.00	0.00
tblArchitecturalCoating	EF_Residential_Interior	150.00	0.00
tblAreaCoating	Area_EF_Nonresidential_Exterior	150	50
tblAreaMitigation	UseLowVOCPaintNonresidentialInteriorValue	150	50
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	80
tblConstDustMitigation	WaterExposedAreaPM10PercentReduction	61	74
tblConstDustMitigation	WaterExposedAreaPM25PercentReduction	61	74
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstructionPhase	NumDays	20.00	55.00
tblConstructionPhase	NumDays	300.00	551.00
tblConstructionPhase	NumDays	30.00	36.00
tblConstructionPhase	NumDays	30.00	36.00
tblGrading	MaterialExported	0.00	24,000.00
tblGrading	MaterialImported	0.00	9,000.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	UsageHours	7.00	4.00
tblProjectCharacteristics	OperationalYear	2014	2016
tblTripsAndVMT	HaulingTripLength	20.00	1.60

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.6910	5.5087	5.4156	6.9400e-003	0.4678	0.2852	0.7530	0.1746	0.2659	0.4405	0.0000	626.4471	626.4471	0.0993	0.0000	628.5313
2015	0.7205	4.8386	5.5632	8.3100e-003	0.2829	0.2801	0.5630	0.0766	0.2633	0.3399	0.0000	720.1364	720.1364	0.0858	0.0000	721.9386
2016	0.9718	2.5414	2.9814	4.7700e-003	0.1651	0.1477	0.3128	0.0447	0.1391	0.1837	0.0000	405.6103	405.6103	0.0470	0.0000	406.5981
Total	**2.3833**	**12.8886**	**13.9602**	**0.0200**	**0.9157**	**0.7130**	**1.6287**	**0.2959**	**0.6682**	**0.9641**	**0.0000**	**1,752.1938**	**1,752.1938**	**0.2321**	**0.0000**	**1,757.0680**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.3241	3.0430	4.8988	6.9400e-003	0.2504	0.1074	0.3577	0.0803	0.1056	0.1859	0.0000	626.4467	626.4467	0.0993	0.0000	628.5309
2015	0.3651	3.0996	5.4450	8.3100e-003	0.2829	0.1099	0.3928	0.0766	0.1080	0.1846	0.0000	720.1361	720.1361	0.0858	0.0000	721.9382
2016	0.7840	1.6224	2.9297	4.7700e-003	0.1651	0.0588	0.2239	0.0447	0.0579	0.1026	0.0000	405.6101	405.6101	0.0470	0.0000	406.5979
Total	**1.4732**	**7.7649**	**13.2734**	**0.0200**	**0.6983**	**0.2761**	**0.9744**	**0.2015**	**0.2715**	**0.4730**	**0.0000**	**1,752.1928**	**1,752.1928**	**0.2321**	**0.0000**	**1,757.0670**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**38.19**	**39.75**	**4.92**	**0.00**	**23.74**	**61.28**	**40.17**	**31.89**	**59.37**	**50.94**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	2.0635	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161
Energy	0.0262	0.2382	0.2001	1.4300e-003		0.0181	0.0181		0.0181	0.0181	0.0000	515.0955	515.0955	0.0167	7.1900e-003	517.6747
Mobile	1.1988	4.3753	13.7546	0.0237	1.3369	0.0605	1.3975	0.3591	0.0556	0.4148	0.0000	1,934.5400	1,934.5400	0.0666	0.0000	1,935.9385
Waste						0.0000	0.0000		0.0000	0.0000	62.9272	0.0000	62.9272	3.7189	0.0000	141.0239
Water						0.0000	0.0000		0.0000	0.0000	18.3412	89.5197	107.8610	1.8879	0.0453	161.5607
Total	**3.2885**	**4.6136**	**13.9627**	**0.0251**	**1.3369**	**0.0787**	**1.4156**	**0.3591**	**0.0738**	**0.4329**	**81.2684**	**2,539.1704**	**2,620.4388**	**5.6902**	**0.0525**	**2,756.2138**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.8310	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161
Energy	0.0262	0.2382	0.2001	1.4300e-003		0.0181	0.0181		0.0181	0.0181	0.0000	423.4502	423.4502	0.0125	6.3200e-003	425.6708
Mobile	0.9999	2.4876	10.1187	0.0120	0.6537	0.0311	0.6848	0.1756	0.0285	0.2041	0.0000	978.3217	978.3217	0.0365	0.0000	979.0881
Waste						0.0000	0.0000		0.0000	0.0000	22.0245	0.0000	22.0245	1.3016	0.0000	49.3584
Water						0.0000	0.0000		0.0000	0.0000	14.6730	65.6343	80.3073	1.5101	0.0362	123.2437
Total	**2.8572**	**2.7260**	**10.3268**	**0.0134**	**0.6537**	**0.0492**	**0.7030**	**0.1756**	**0.0467**	**0.2223**	**36.6975**	**1,467.4214**	**1,504.1189**	**2.8607**	**0.0425**	**1,577.3770**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**13.12**	**40.92**	**26.04**	**46.43**	**51.10**	**37.43**	**50.34**	**51.10**	**36.71**	**48.65**	**54.84**	**42.21**	**42.60**	**49.73**	**19.02**	**42.77**

2.3 Vegetation

Vegetation

	CO2e
Category	MT
New Trees	0.0000
Vegetation Land Change	0.0000
Total	**0.0000**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Grading	Grading	3/1/2014	4/21/2014	5	36	CE
2	Detention Basin Expansion	Grading	4/22/2014	6/10/2014	5	36	
3	Construction	Building Construction	6/11/2014	7/20/2016	5	551	DMP
4	Architectural Coating	Architectural Coating	7/21/2016	10/5/2016	5	55	DMP

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 90

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 385,800; Non-Residential Outdoor: 128,600 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Detention Basin Expansion	Excavators	1	8.00	162	0.38
Detention Basin Expansion	Graders	1	8.00	174	0.41
Detention Basin Expansion	Rubber Tired Dozers	1	8.00	255	0.40
Detention Basin Expansion	Scrapers	1	8.00	361	0.48
Detention Basin Expansion	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Construction	Cranes	1	4.00	226	0.29
Construction	Forklifts	3	8.00	89	0.20
Construction	Generator Sets	1	8.00	84	0.74
Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Grading	7	18.00	0.00	1,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Detention Basin Expansion	5	13.00	0.00	2,373.00	10.80	7.30	1.60	LD_Mix	HDT_Mix	HHDT
Construction	9	206.00	80.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	41.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Water Unpaved Roads

Reduce Vehicle Speed on Unpaved Roads

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1568	0.0000	0.1568	0.0648	0.0000	0.0648	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1156	1.3620	0.8669	1.0200e-003		0.0654	0.0654		0.0601	0.0601	0.0000	97.8716	97.8716	0.0289	0.0000	98.4790
Total	**0.1156**	**1.3620**	**0.8669**	**1.0200e-003**	**0.1568**	**0.0654**	**0.2221**	**0.0648**	**0.0601**	**0.1250**	**0.0000**	**97.8716**	**97.8716**	**0.0289**	**0.0000**	**98.4790**

3.2 Grading - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	9.6200e-003	3.8900e-003	0.0135	2.6500e-003	3.5800e-003	6.2300e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**0.0122**	**3.9100e-003**	**0.0161**	**3.3400e-003**	**3.6000e-003**	**6.9400e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0408	0.0000	0.0408	0.0169	0.0000	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.5326	0.6107	1.0200e-003		0.0220	0.0220		0.0220	0.0220	0.0000	97.8715	97.8715	0.0289	0.0000	98.4789
Total	**0.0265**	**0.5326**	**0.6107**	**1.0200e-003**	**0.0408**	**0.0220**	**0.0628**	**0.0169**	**0.0220**	**0.0389**	**0.0000**	**97.8715**	**97.8715**	**0.0289**	**0.0000**	**98.4789**

3.2 Grading - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0185	0.2102	0.1918	4.2000e-004	9.6200e-003	3.8900e-003	0.0135	2.6500e-003	3.5800e-003	6.2300e-003	0.0000	39.3976	39.3976	3.6000e-004	0.0000	39.4052
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6000e-003	2.0000e-003	0.0199	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.4979	2.4979	1.6000e-004	0.0000	2.5012
Total	**0.0201**	**0.2122**	**0.2118**	**4.5000e-004**	**0.0122**	**3.9100e-003**	**0.0161**	**3.3400e-003**	**3.6000e-003**	**6.9400e-003**	**0.0000**	**41.8955**	**41.8955**	**5.2000e-004**	**0.0000**	**41.9064**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1370	0.0000	0.1370	0.0627	0.0000	0.0627	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0827	0.9555	0.6088	6.9000e-004		0.0465	0.0465		0.0428	0.0428	0.0000	66.6469	66.6469	0.0197	0.0000	67.0605
Total	**0.0827**	**0.9555**	**0.6088**	**6.9000e-004**	**0.1370**	**0.0465**	**0.1836**	**0.0627**	**0.0428**	**0.1055**	**0.0000**	**66.6469**	**66.6469**	**0.0197**	**0.0000**	**67.0605**

3.3 Detention Basin Expansion - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	1.6500e-003	7.9000e-004	2.4300e-003	4.6000e-004	7.2000e-004	1.1800e-003	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	1.8700e-003	2.0000e-005	1.8900e-003	5.0000e-004	2.0000e-005	5.1000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**3.5200e-003**	**8.1000e-004**	**4.3200e-003**	**9.6000e-004**	**7.4000e-004**	**1.6900e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0356	0.0000	0.0356	0.0163	0.0000	0.0163	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0185	0.3738	0.4255	6.9000e-004		0.0150	0.0150		0.0150	0.0150	0.0000	66.6468	66.6468	0.0197	0.0000	67.0604
Total	**0.0185**	**0.3738**	**0.4255**	**6.9000e-004**	**0.0356**	**0.0150**	**0.0506**	**0.0163**	**0.0150**	**0.0313**	**0.0000**	**66.6468**	**66.6468**	**0.0197**	**0.0000**	**67.0604**

3.3 Detention Basin Expansion - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0234	0.0625	0.3227	1.0000e-004	1.6500e-003	7.9000e-004	2.4300e-003	4.6000e-004	7.2000e-004	1.1800e-003	0.0000	8.4671	8.4671	1.2000e-004	0.0000	8.4695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1500e-003	1.4500e-003	0.0144	2.0000e-005	1.8700e-003	2.0000e-005	1.8900e-003	5.0000e-004	2.0000e-005	5.1000e-004	0.0000	1.8041	1.8041	1.1000e-004	0.0000	1.8064
Total	**0.0245**	**0.0639**	**0.3371**	**1.2000e-004**	**3.5200e-003**	**8.1000e-004**	**4.3200e-003**	**9.6000e-004**	**7.4000e-004**	**1.6900e-003**	**0.0000**	**10.2711**	**10.2711**	**2.3000e-004**	**0.0000**	**10.2759**

3.4 Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2615	2.0328	1.2956	1.8000e-003		0.1512	0.1512		0.1426	0.1426	0.0000	164.5543	164.5543	0.0412	0.0000	165.4201
Total	**0.2615**	**2.0328**	**1.2956**	**1.8000e-003**		**0.1512**	**0.1512**		**0.1426**	**0.1426**	**0.0000**	**164.5543**	**164.5543**	**0.0412**	**0.0000**	**165.4201**

3.4 Construction - 2014

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1124	0.7892	1.1699	1.4000e-003	0.0380	0.0163	0.0543	0.0109	0.0150	0.0259	0.0000	129.2706	129.2706	1.4200e-003	0.0000	129.3004
Worker	0.0742	0.0930	0.9257	1.4500e-003	0.1202	1.0800e-003	0.1213	0.0320	9.8000e-004	0.0329	0.0000	115.9371	115.9371	7.2300e-003	0.0000	116.0890
Total	**0.1866**	**0.8823**	**2.0955**	**2.8500e-003**	**0.1582**	**0.0174**	**0.1756**	**0.0428**	**0.0160**	**0.0588**	**0.0000**	**245.2077**	**245.2077**	**8.6500e-003**	**0.0000**	**245.3895**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0480	0.9782	1.2183	1.8000e-003		0.0483	0.0483		0.0483	0.0483	0.0000	164.5541	164.5541	0.0412	0.0000	165.4199
Total	**0.0480**	**0.9782**	**1.2183**	**1.8000e-003**		**0.0483**	**0.0483**		**0.0483**	**0.0483**	**0.0000**	**164.5541**	**164.5541**	**0.0412**	**0.0000**	**165.4199**

3.4 Construction - 2014

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1124	0.7892	1.1699	1.4000e-003	0.0380	0.0163	0.0543	0.0109	0.0150	0.0259	0.0000	129.2706	129.2706	1.4200e-003	0.0000	129.3004
Worker	0.0742	0.0930	0.9257	1.4500e-003	0.1202	1.0800e-003	0.1213	0.0320	9.8000e-004	0.0329	0.0000	115.9371	115.9371	7.2300e-003	0.0000	116.0890
Total	**0.1866**	**0.8823**	**2.0955**	**2.8500e-003**	**0.1582**	**0.0174**	**0.1756**	**0.0428**	**0.0160**	**0.0588**	**0.0000**	**245.2077**	**245.2077**	**8.6500e-003**	**0.0000**	**245.3895**

3.4 Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4412	3.4878	2.2961	3.2200e-003		0.2566	0.2566		0.2416	0.2416	0.0000	292.1149	292.1149	0.0720	0.0000	293.6277
Total	**0.4412**	**3.4878**	**2.2961**	**3.2200e-003**		**0.2566**	**0.2566**		**0.2416**	**0.2416**	**0.0000**	**292.1149**	**292.1149**	**0.0720**	**0.0000**	**293.6277**

3.4 Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1630	1.2048	1.8191	2.4900e-003	0.0679	0.0218	0.0897	0.0195	0.0200	0.0395	0.0000	227.9399	227.9399	2.1700e-003	0.0000	227.9855
Worker	0.1164	0.1460	1.4480	2.5900e-003	0.2149	1.7900e-003	0.2167	0.0571	1.6300e-003	0.0588	0.0000	200.0816	200.0816	0.0116	0.0000	200.3254
Total	**0.2794**	**1.3508**	**3.2671**	**5.0800e-003**	**0.2829**	**0.0236**	**0.3064**	**0.0766**	**0.0216**	**0.0982**	**0.0000**	**428.0216**	**428.0216**	**0.0138**	**0.0000**	**428.3109**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0857	1.7487	2.1779	3.2200e-003		0.0864	0.0864		0.0864	0.0864	0.0000	292.1145	292.1145	0.0720	0.0000	293.6273
Total	**0.0857**	**1.7487**	**2.1779**	**3.2200e-003**		**0.0864**	**0.0864**		**0.0864**	**0.0864**	**0.0000**	**292.1145**	**292.1145**	**0.0720**	**0.0000**	**293.6273**

3.4 Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1630	1.2048	1.8191	2.4900e-003	0.0679	0.0218	0.0897	0.0195	0.0200	0.0395	0.0000	227.9399	227.9399	2.1700e-003	0.0000	227.9855
Worker	0.1164	0.1460	1.4480	2.5900e-003	0.2149	1.7900e-003	0.2167	0.0571	1.6300e-003	0.0588	0.0000	200.0816	200.0816	0.0116	0.0000	200.3254
Total	**0.2794**	**1.3508**	**3.2671**	**5.0800e-003**	**0.2829**	**0.0236**	**0.3064**	**0.0766**	**0.0216**	**0.0982**	**0.0000**	**428.0216**	**428.0216**	**0.0138**	**0.0000**	**428.3109**

3.4 Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2258	1.8221	1.2519	1.7800e-003		0.1312	0.1312		0.1235	0.1235	0.0000	159.9914	159.9914	0.0389	0.0000	160.8085
Total	**0.2258**	**1.8221**	**1.2519**	**1.7800e-003**		**0.1312**	**0.1312**		**0.1235**	**0.1235**	**0.0000**	**159.9914**	**159.9914**	**0.0389**	**0.0000**	**160.8085**

3.4 Construction - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0790	0.5775	0.9215	1.3700e-003	0.0375	0.0101	0.0476	0.0107	9.2800e-003	0.0200	0.0000	124.2421	124.2421	1.0800e-003	0.0000	124.2648
Worker	0.0565	0.0712	0.7028	1.4300e-003	0.1186	9.3000e-004	0.1195	0.0315	8.5000e-004	0.0324	0.0000	106.2764	106.2764	5.7800e-003	0.0000	106.3978
Total	**0.1355**	**0.6487**	**1.6243**	**2.8000e-003**	**0.1561**	**0.0110**	**0.1671**	**0.0423**	**0.0101**	**0.0524**	**0.0000**	**230.5185**	**230.5185**	**6.8600e-003**	**0.0000**	**230.6626**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0473	0.9648	1.2016	1.7800e-003		0.0476	0.0476		0.0476	0.0476	0.0000	159.9912	159.9912	0.0389	0.0000	160.8083
Total	**0.0473**	**0.9648**	**1.2016**	**1.7800e-003**		**0.0476**	**0.0476**		**0.0476**	**0.0476**	**0.0000**	**159.9912**	**159.9912**	**0.0389**	**0.0000**	**160.8083**

3.4 Construction - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0790	0.5775	0.9215	1.3700e-003	0.0375	0.0101	0.0476	0.0107	9.2800e-003	0.0200	0.0000	124.2421	124.2421	1.0800e-003	0.0000	124.2648
Worker	0.0565	0.0712	0.7028	1.4300e-003	0.1186	9.3000e-004	0.1195	0.0315	8.5000e-004	0.0324	0.0000	106.2764	106.2764	5.7800e-003	0.0000	106.3978
Total	**0.1355**	**0.6487**	**1.6243**	**2.8000e-003**	**0.1561**	**0.0110**	**0.1671**	**0.0423**	**0.0101**	**0.0524**	**0.0000**	**230.5185**	**230.5185**	**6.8600e-003**	**0.0000**	**230.6626**

3.5 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5961					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0101	0.0652	0.0518	8.0000e-005		5.4100e-003	5.4100e-003		5.4100e-003	5.4100e-003	0.0000	7.0215	7.0215	8.3000e-004	0.0000	7.0388
Total	**0.6062**	**0.0652**	**0.0518**	**8.0000e-005**		**5.4100e-003**	**5.4100e-003**		**5.4100e-003**	**5.4100e-003**	**0.0000**	**7.0215**	**7.0215**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.3000e-003	5.4100e-003	0.0534	1.1000e-004	9.0100e-003	7.0000e-005	9.0800e-003	2.4000e-003	6.0000e-005	2.4600e-003	0.0000	8.0789	8.0789	4.4000e-004	0.0000	8.0882
Total	**4.3000e-003**	**5.4100e-003**	**0.0534**	**1.1000e-004**	**9.0100e-003**	**7.0000e-005**	**9.0800e-003**	**2.4000e-003**	**6.0000e-005**	**2.4600e-003**	**0.0000**	**8.0789**	**8.0789**	**4.4000e-004**	**0.0000**	**8.0882**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5961					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.2000e-004	3.5400e-003	0.0504	8.0000e-005		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	7.0214	7.0214	8.3000e-004	0.0000	7.0388
Total	**0.5969**	**3.5400e-003**	**0.0504**	**8.0000e-005**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**7.0214**	**7.0214**	**8.3000e-004**	**0.0000**	**7.0388**

3.5 Architectural Coating - 2016

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.3000e-003	5.4100e-003	0.0534	1.1000e-004	9.0100e-003	7.0000e-005	9.0800e-003	2.4000e-003	6.0000e-005	2.4600e-003	0.0000	8.0789	8.0789	4.4000e-004	0.0000	8.0882
Total	**4.3000e-003**	**5.4100e-003**	**0.0534**	**1.1000e-004**	**9.0100e-003**	**7.0000e-005**	**9.0800e-003**	**2.4000e-003**	**6.0000e-005**	**2.4600e-003**	**0.0000**	**8.0789**	**8.0789**	**4.4000e-004**	**0.0000**	**8.0882**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Density

Increase Diversity

Improve Walkability Design

Improve Destination Accessibility

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

Implement NEV Network

Limit Parking Supply

Increase Transit Frequency

Implement Trip Reduction Program

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.9999	2.4876	10.1187	0.0120	0.6537	0.0311	0.6848	0.1756	0.0285	0.2041	0.0000	978.3217	978.3217	0.0365	0.0000	979.0881
Unmitigated	1.1988	4.3753	13.7546	0.0237	1.3369	0.0605	1.3975	0.3591	0.0556	0.4148	0.0000	1,934.5400	1,934.5400	0.0666	0.0000	1,935.9385

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Light Industry	1,394.00	264.00	136.00	3,073,828	1,503,029
Manufacturing	191.00	74.50	31.00	442,306	216,277
Parking Lot	0.00	0.00	0.00		
Total	1,585.00	338.50	167.00	3,516,134	1,719,306

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
General Light Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3
Manufacturing	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.413014	0.062673	0.156172	0.176687	0.051255	0.007895	0.018867	0.100331	0.001803	0.001598	0.006448	0.000946	0.002310

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: Y

5.1 Mitigation Measures Energy

Install High Efficiency Lighting

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	164.1021	164.1021	7.5400e-003	1.5600e-003	164.7443
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	255.7474	255.7474	0.0118	2.4300e-003	256.7482
NaturalGas Mitigated	0.0262	0.2382	0.2001	1.4300e-003		0.0181	0.0181		0.0181	0.0181	0.0000	259.3481	259.3481	4.9700e-003	4.7500e-003	260.9265
NaturalGas Unmitigated	0.0262	0.2382	0.2001	1.4300e-003		0.0181	0.0181		0.0181	0.0181	0.0000	259.3481	259.3481	4.9700e-003	4.7500e-003	260.9265

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					
General Light Industry	3.888e+006	0.0210	0.1906	0.1601	1.1400e-003		0.0145	0.0145		0.0145	0.0145	0.0000	207.4785	207.4785	3.9800e-003	3.8000e-003	208.7412
Manufacturing	972000	5.2400e-003	0.0477	0.0400	2.9000e-004		3.6200e-003	3.6200e-003		3.6200e-003	3.6200e-003	0.0000	51.8696	51.8696	9.9000e-004	9.5000e-004	52.1853
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0262**	**0.2382**	**0.2001**	**1.4300e-003**		**0.0181**	**0.0181**		**0.0181**	**0.0181**	**0.0000**	**259.3481**	**259.3481**	**4.9700e-003**	**4.7500e-003**	**260.9265**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Manufacturing	972000	5.2400e-003	0.0477	0.0400	2.9000e-004		3.6200e-003	3.6200e-003		3.6200e-003	3.6200e-003	0.0000	51.8696	51.8696	9.9000e-004	9.5000e-004	52.1853
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
General Light Industry	3.888e+006	0.0210	0.1906	0.1601	1.1400e-003		0.0145	0.0145		0.0145	0.0145	0.0000	207.4785	207.4785	3.9800e-003	3.8000e-003	208.7412
Total		**0.0262**	**0.2382**	**0.2001**	**1.4300e-003**		**0.0181**	**0.0181**		**0.0181**	**0.0181**	**0.0000**	**259.3481**	**259.3481**	**4.9700e-003**	**4.7500e-003**	**260.9265**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	546000	156.2471	7.1800e-003	1.4900e-003	156.8586
Manufacturing	136500	39.0618	1.8000e-003	3.7000e-004	39.2147
Parking Lot	211200	60.4385	2.7800e-003	5.7000e-004	60.6750
Total		**255.7474**	**0.0118**	**2.4300e-003**	**256.7482**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	413140	118.2270	5.4300e-003	1.1200e-003	118.6897
Manufacturing	103285	29.5568	1.3600e-003	2.8000e-004	29.6724
Parking Lot	57024	16.3184	7.5000e-004	1.6000e-004	16.3822
Total		**164.1021**	**7.5400e-003**	**1.5600e-003**	**164.7443**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

No Hearths Installed

Use Low VOC Cleaning Supplies

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.8310	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161
Unmitigated	2.0635	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1490					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.9137					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.8000e-004	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161
Total	**2.0635**	**8.0000e-005**	**8.0100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0152**	**0.0152**	**4.0000e-005**	**0.0000**	**0.0161**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0596					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.7706					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.8000e-004	8.0000e-005	8.0100e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0152	0.0152	4.0000e-005	0.0000	0.0161
Total	**1.8310**	**8.0000e-005**	**8.0100e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0152**	**0.0152**	**4.0000e-005**	**0.0000**	**0.0161**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Turf Reduction

Use Water Efficient Irrigation System

Use Water Efficient Landscaping

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	80.3073	1.5101	0.0362	123.2437
Unmitigated	107.8610	1.8879	0.0453	161.5607

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	46.25 / 0	86.2888	1.5104	0.0363	129.2485
Manufacturing	11.5625 / 0	21.5722	0.3776	9.0700e-003	32.3121
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**107.8610**	**1.8879**	**0.0453**	**161.5607**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	37 / 0	64.2458	1.2081	0.0290	98.5949
Manufacturing	9.25 / 0	16.0615	0.3020	7.2400e-003	24.6487
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**80.3073**	**1.5101**	**0.0362**	**123.2437**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	22.0245	1.3016	0.0000	49.3584
Unmitigated	62.9272	3.7189	0.0000	141.0239

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	248	50.3418	2.9751	0.0000	112.8191
Manufacturing	62	12.5854	0.7438	0.0000	28.2048
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**62.9272**	**3.7189**	**0.0000**	**141.0239**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	86.8	17.6196	1.0413	0.0000	39.4867
Manufacturing	21.7	4.4049	0.2603	0.0000	9.8717
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**22.0245**	**1.3016**	**0.0000**	**49.3584**

9.0 Operational Offroad

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

10.0 Vegetation

	Total CO2	CH4	N2O	CO2e
Category	MT			
Unmitigated	0.0000	0.0000	0.0000	0.0000

10.1 Vegetation Land Change

Vegetation Type

	Initial/Final	Total CO2	CH4	N2O	CO2e
	Acres	MT			
Others	44.64 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

10.2 Net New Trees

Species Class

	Number of Trees	Total CO2	CH4	N2O	CO2e
		MT			
Aspen	0	0.0000	0.0000	0.0000	0.0000
Hardwood Maple	0	0.0000	0.0000	0.0000	0.0000
Juniper	0	0.0000	0.0000	0.0000	0.0000
Miscellaneous	0	0.0000	0.0000	0.0000	0.0000
Mixed Hardwood	0	0.0000	0.0000	0.0000	0.0000
Soft Maple	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Attachment B

Mall Model Spreadsheets For Opening Day and Cumulative Project Scenario

Fast Food Restaurants

District Default Values						
Usage			Average Lb/week			
Facility Type	Description	Controls*	Hamburger	Poultry w/ skin	Poultry w/o skin	Pork
1	CD-Charbroiler	**86%**	**800**		**265**	
2	Flat Griddle	**0%**	**360**		**110**	**110**
3	UF-Charbroiler	**0%**	**270**	**145**		
4	Flat Griddle	**0%**			**110**	**110**
*w/ District Required Control Equipment						

Emission Factors		Lb/Ton of meat							
		Hamburger		Poultry w/ skin		Poultry w/o skin		Pork	
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene
1	CD-Charbroiler	**0.000724**	**0.046**			**0.00046**	**0.018**		
2	Flat Griddle	**0.000054**	**0.012**			**0.000044**	**0.018**	**0.000044**	**0**
3	UF-Charbroiler	**0.000702**	**0.038**	**0.00046**	**0.018**				
4	Flat Griddle					**0.000044**	**0.018**	**0.000044**	**0**

Emission Summary		Hamburger		Poultry w/ skin		Poultry w/o skin		Pork	
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene
1	CD-Charbroiler	2.11E-03	1.34E-01	0.00E+00	0.00E+00	4.44E-04	1.74E-02	0.00E+00	####
2	Flat Griddle	5.05E-04	1.12E-01	0.00E+00	0.00E+00	1.26E-04	5.15E-02	1.26E-04	####
3	UF-Charbroiler	4.93E-03	2.67E-01	1.73E-03	6.79E-02	0.00E+00	0.00E+00	0.00E+00	####
4	Flat Griddle	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-04	5.15E-02	1.26E-04	####

How to us this worksheet:

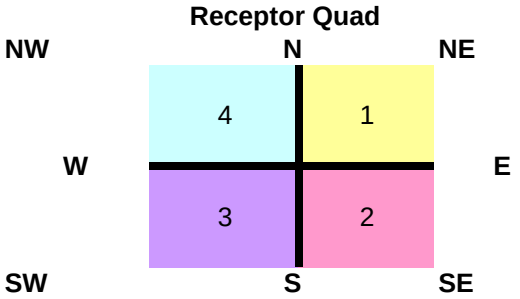
This worksheet allows the user to enter the proposed quantity for each type of meat cooked by type of operation. If the user is uncertain which type of operation will be used for a single proposed fast food location then the emissions from the highest priority operation with the District's default values should be used.

Examples:

1) Proposed site has two fast food locations. The user will use Facility Type 1 and 2.
2) Proposed site has four fast food locations. The user will use Facility Type 1,2,3, and 4.
3) Proposed site has six fast food locations. The user will use Facility Type 1,2,3, and 4 for the first four locations
   For all other locations Facility Type 4 should be used.

Stack Parameters: Height = 5ft above roof height, Temperature = 200 F, Velocity = 1210 ft/min, Diameter = 1 ft

Facility Name : Grapevine Shopping Center (Opening Day/Near Term)
Project #: 1
Date: 3/5/2014
Quad: 1
Receptor Distance: 1500
Location: u (U = Urban or R = Rural)



Calculate Risk

Risk Summary		Total (Lb/Yr)		Total (Lb/Hr)		Risk		
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	Total Risk
1	CD-Charbroiler	2.55E-03	1.51E-01	2.91E-07	1.73E-05	1.31E-09	5.32E-11	1.3589E-09
2	Flat Griddle	7.57E-04	1.70E-01	8.64E-08	1.94E-05	3.87E-10	5.96E-11	4.46958E-10
3	UF-Charbroiler	6.66E-03	3.35E-01	7.61E-07	3.82E-05	3.41E-09	1.18E-10	3.52629E-09
4	Flat Griddle	2.52E-04	5.72E-02	2.87E-08	6.53E-06	1.29E-10	2.01E-11	1.48875E-10
								5.48102E-09

Sum of all potential restaurants (13) = 6.8209E-09

*Sum= I51+(I50*9)

Truck Idling & TRU's

Date : 3/5/2014
Facility Name: Grapevine Shopping Center (Opening Day/Near Term
Facility Location: Delano, CA
Facility ID #:

Calculate Risk

Receptor Quad

NW	N	NE
4	1	
3	2	
SW	S	SE

W E

Unit #	Unit Type T = TRU HH = High Horizontal HV = High Vertical LL = Low Level	Operational Time / Event (Hour)	PM10 g/hr	Events/ Year	Receptor Distance (m)	Quad	Load %	Emissions Lb / Yr	**Location** U=Urban UB=Urban Near Building R=Rural RB=Rural Near Building	Unit Risk
1	hh	0.083	2.57	8613	460	1	100	4.05E+00	U	**2.73E-08**
2	t	0.083	2.57	8613	460	1	100	4.05E+00	U	**2.72E-08**
									Average=	**2.73E-08**

8613= 50+9+40/3=33*261 (5 days per week, 52 weeks per year)
5 minute idle= 0.083 operational time/hour
2.57 g/hr = District Default

Truck Travel

Date : 3/5/2014
Facility Name: Grapevine Shopping Center (Opening Day/Near Term
Facility Location: Delano, CA
Facility ID #:

Receptor Quad

NW	N	NE
W	4 / 1	E
	3 / 2	
SW	S	SE

Calculate Risk

Unit #	Segment Direction EW = East-West NS = North-South NWSE = Northwest-Southeast NESW = Northeast-Southwest	# (50m) Segments	PM10 g/mi	Events/ Year	Receptor Distance (m)	Quad	Load %	Emissions Lb / Yr	Location U=Urban R=Rural	Segment Risk
1	EW	2	0.252	8613	1015	4	100	2.97E-01	u	**1.23E-09**
2	EW	2	0.252	8613	991	4	100	2.97E-01	u	**1.23E-09**
3	EW	2	0.252	8613	966	4	100	2.97E-01	u	**1.23E-09**
4	EW	2	0.252	8613	942	4	100	2.97E-01	u	**1.23E-09**
5	EW	2	0.252	8613	923	4	100	2.97E-01	u	**1.23E-09**
6	EW	2	0.252	8613	908	4	100	2.97E-01	u	**1.23E-09**
7	EW	2	0.252	8613	894	4	100	2.97E-01	u	**1.23E-09**
8	EW	2	0.252	8613	880	4	100	2.97E-01	u	**1.23E-09**
9	EW	2	0.252	8613	874	4	100	2.97E-01	u	**1.23E-09**
10	EW	2	0.252	8613	868	4	100	2.97E-01	u	**1.23E-09**
11	NS	2	0.252	8613	837	4	100	2.97E-01	u	**1.23E-09**
12	NS	2	0.252	8613	787	4	100	2.97E-01	u	**2.47E-09**
13	NS	2	0.252	8613	738	4	100	2.97E-01	u	**2.47E-09**
14	NS	2	0.252	8613	691	4	100	2.97E-01	u	**2.47E-09**
15	NS	2	0.252	8613	642	4	100	2.97E-01	u	**2.47E-09**
16	NS	2	0.252	8613	586	4	100	2.97E-01	u	**3.70E-09**
17	NS	2	0.252	8613	537	4	100	2.97E-01	u	**3.70E-09**
18	NS	2	0.252	8613	488	4	100	2.97E-01	u	**4.93E-09**
19	EW	2	0.252	8613	461	4	100	2.97E-01	u	**4.93E-09**
20	EW	2	0.252	8613	460	1	100	2.97E-01	u	**2.47E-09**
21	EW	2	0.252	8613	463	1	100	2.97E-01	u	**2.47E-09**
22	EW	2	0.252	8613	465	1	100	2.97E-01	u	**2.47E-09**
23	EW	2	0.252	8613	471	1	100	2.97E-01	u	**2.47E-09**
24	EW	2	0.252	8613	485	1	100	2.97E-01	u	**2.47E-09**
									Sum	**5.30E-08**

0.252 g/mi= District Default
8613= 50+9+40/3=33*261 (5 days per week, 52 weeks per year)
Marketplace deliveries=50 delivery trucks per day
Westlake= 5 HHDT 5 days per week, 52 weeks per year
4 TRU trips per day, 5 days per week, 52 weeks per year
Madera Foxglove- 40 daily truck deliveries per day

Fast Food Restaurants

District Default Values						
Usage			Average Lb/week			
Facility Type	Description	Controls*	Hamburger	Poultry w/ skin	Poultry w/o skin	Pork
1	CD-Charbroiler	**86%**	**800**		**265**	
2	Flat Griddle	**0%**	**360**		**110**	**110**
3	UF-Charbroiler	**0%**	**270**	**145**		
4	Flat Griddle	**0%**			**110**	**110**
*w/ District Required Control Equipment						

Emission Factors		Lb/Ton of meat							
		Hamburger		Poultry w/ skin		Poultry w/o skin		Pork	
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene
1	CD-Charbroiler	**0.000724**	**0.046**			**0.00046**	**0.018**		
2	Flat Griddle	**0.000054**	**0.012**			**0.000044**	**0.018**	**0.000044**	**0**
3	UF-Charbroiler	**0.000702**	**0.038**	**0.00046**	**0.018**				
4	Flat Griddle					**0.000044**	**0.018**	**0.000044**	**0**

Emission Summary		Hamburger		Poultry w/ skin		Poultry w/o skin		Pork	
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene
1	CD-Charbroiler	2.11E-03	1.34E-01	0.00E+00	0.00E+00	4.44E-04	1.74E-02	0.00E+00	###
2	Flat Griddle	5.05E-04	1.12E-01	0.00E+00	0.00E+00	1.26E-04	5.15E-02	1.26E-04	###
3	UF-Charbroiler	4.93E-03	2.67E-01	1.73E-03	6.79E-02	0.00E+00	0.00E+00	0.00E+00	###
4	Flat Griddle	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-04	5.15E-02	1.26E-04	###

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This worksheet allows the user to enter the proposed quantity for each type of meat cooked by type of operation. If the user is uncertain which type of operation will be used for a single proposed fast food location then the emissions from the highest priority operation with the District's default values should be used.

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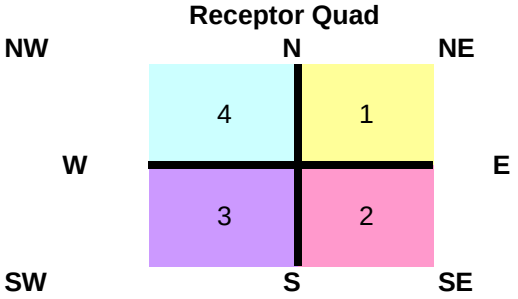
3) Proposed site has six fast food locations. The user will use Facility Type 1,2,3, and 4 for the first four locations
   For all other locations Facility Type 4 should be used.

Stack Parameters: Height = 5ft above roof height, Temperature = 200 F, Velocity = 1210 ft/min, Diameter = 1 ft

Facility Name : Grapevine Shopping Center (Cumulative Project)
Project #: 1
Date: 3/5/2014
Quad: 1
Receptor Distance: 175
Location: u (U = Urban or R = Rural)



Calculate Risk

Risk Summary		Total (Lb/Yr)		Total (Lb/Hr)		Risk		
Facility Type	Description	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	PAH wo/Na-phthalene	Naph-thalene	Total Risk
1	CD-Charbroiler	2.55E-03	1.51E-01	2.91E-07	1.73E-05	3.57E-08	1.45E-09	3.71573E-08
2	Flat Griddle	7.57E-04	1.70E-01	8.64E-08	1.94E-05	1.06E-08	1.63E-09	1.22215E-08
3	UF-Charbroiler	6.66E-03	3.35E-01	7.61E-07	3.82E-05	9.32E-08	3.22E-09	9.64221E-08
4	Flat Griddle	2.52E-04	5.72E-02	2.87E-08	6.53E-06	3.52E-09	5.5E-10	4.0708E-09
								1.49872E-07

Sum of all Potential Restaurants (13) = 1.86509E-07

*Sum= I51+(I50*9)

Sum of all Potential Cumulative Restaurants (13*3=39)= 5.59527E-07

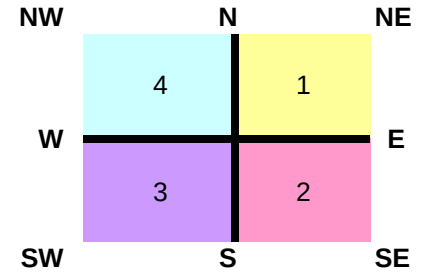
TOTAL TAC= 5.60E-07

Truck Idling & TRU's

Date : 3/5/2014
Facility Name: Grapevine Shopping Center (Cumulative Project)
Facility Location: Delano, CA
Facility ID #:

Calculate Risk

Receptor Quad



Unit #	Unit Type T = TRU HH = High Horizontal HV = High Vertical LL = Low Level	Operational Time / Event (Hour)	PM10 g/hr	Events/ Year	Receptor Distance (m)	Quad	Load %	Emissions Lb / Yr	U=Urban UB=Urban Near Building R=Rural RB=Rural Near Building	Unit Risk
1	hh	0.083	2.57	8613	55	4	100	4.05E+00	U	**5.80E-08**
2	t	0.083	2.57	8613	55	4	100	4.05E+00	U	**5.78E-08**
									Average=	**5.79E-08**

8613= 50+9+40/3=33*261 (5 days per week, 52 weeks per year)

5 minute idle= 0.083 operational time/hour

2.57 g/hr = District Default

Average*3= 1.74E-07

Truck Travel

Date : 3/5/2014
Facility Name: Grapevine Shopping Center (Cumulative Project)
Facility Location: Delano, CA
Facility ID #:

Receptor Quad

NW	N	NE
W	4 | 1	E
	3 | 2	
SW	S	SE

Calculate Risk

Unit #	Segment Direction EW = East-West NS = North-South NWSE = Northwest-Southeast NESW = Northeast-Southwest	# (50m) Segments	PM10 g/mi	Events/ Year	Receptor Distance (m)	Quad	Load %	Emissions Lb / Yr	Location U=Urban R=Rural	Segment Risk
1	EW	2	0.252	8613	792	4	100	2.97E-01	u	**8.62E-09**
2	EW	2	0.252	8613	748	4	100	2.97E-01	u	**8.62E-09**
3	EW	2	0.252	8613	710	4	100	2.97E-01	u	**8.62E-09**
4	EW	2	0.252	8613	675	4	100	2.97E-01	u	**2.47E-09**
5	EW	2	0.252	8613	638	4	100	2.97E-01	u	**2.47E-09**
6	EW	2	0.252	8613	607	4	100	2.97E-01	u	**2.47E-09**
7	EW	2	0.252	8613	575	4	100	2.97E-01	u	**2.47E-09**
8	EW	2	0.252	8613	544	4	100	2.97E-01	u	**2.47E-09**
9	EW	2	0.252	8613	520	4	100	2.97E-01	u	**2.47E-09**
10	EW	2	0.252	8613	500	4	100	2.97E-01	u	**3.70E-09**
11	NS	2	0.252	8613	465	4	100	2.97E-01	u	**3.70E-09**
12	NS	2	0.252	8613	419	4	100	2.97E-01	u	**3.70E-09**
13	NS	2	0.252	8613	373	4	100	2.97E-01	u	**4.93E-09**
14	NS	2	0.252	8613	332	4	100	2.97E-01	u	**4.93E-09**
15	NS	2	0.252	8613	288	4	100	2.97E-01	u	**4.93E-09**
16	NS	2	0.252	8613	245	4	100	2.97E-01	u	**6.16E-09**
17	NS	2	0.252	8613	219	4	100	2.97E-01	u	**8.63E-09**
18	NS	2	0.252	8613	194	4	100	2.97E-01	u	**1.11E-08**
19	EW	2	0.252	8613	160	4	100	2.97E-01	u	**1.60E-08**
20	EW	2	0.252	8613	115	4	100	2.97E-01	u	**1.60E-08**
21	EW	2	0.252	8613	76	4	100	2.97E-01	u	**2.47E-08**
22	EW	2	0.252	8613	55	4	100	2.97E-01	u	**3.08E-08**
23	EW	2	0.252	8613	55	1	100	2.97E-01	u	**3.08E-08**
24	EW	2	0.252	8613	55	1	100	2.97E-01	u	**4.93E-08**
									SUM	**2.60E-07**

0.252 g/mi= District Default
8613= 50+9+40/3=33*261 (5 days per week, 52 weeks per year)
Marketplace deliveries=50 delivery trucks per day **Sum*3= 7.80E-07**
Westlake= 5 HHDT 5 days per week, 52 weeks per year
4 TRU trips per day, 5 days per week, 52 weeks per year
Madera Foxglove- 40 daily truck deliveries per day

APPENDIX 3.4

BIOLOGICAL STUDIES

Appendix 3.4-1 Biological Study: Special Status Species Occurring In or Near the Project Area

In preparing environmental review documents for the proposed Grapevine Project site in Delano, California, BSK conducted a biological resources review to determine potential impacts of the proposed project to special status plant and animal species, and sensitive habitats in the project area. This process included site reconnaissance visits and a review of historical records of species occurrences. Site reconnaissance visits occurred on February 6 and May 30 of 2013.

Project Setting

The approximately 45-acre project site is located within the City of Delano, Kern County, California (Township 25 South, Range 25 East, Section 14) (Figure 1 Project Vicinity). The southern boundary of the site is Woollomes Avenue, approximately one-third of a mile west of State Highway 99 (Figure 2. Site Area). Habitat within the project site consists of ruderal grassland and farm field (Photos). The site contains a demolished residence in the northeast corner, and a temporary stormwater detention basin at the southeast corner. The immediate surrounding areas contain a combination of agricultural and urban uses.

Special Status Species

To determine which special status species may occur in the project area, site reconnaissance visits were conducted and species occurrence data was analyzed for proximity to the project site.

Site Reconnaissance

Wildlife species observed by BSK during the February 6, 2013 site reconnaissance included: black-tailed jackrabbit (*Lepus californicus)*, red-tailed hawk (*Buteo jamaicensis*), Northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), Western kingbird (*Tyrannus verticalis*), turkey vulture (*Cathartes aura*), and various insects. Numerous California ground squirrel burrows were identified throughout the ruderal field. Burrows occurred in both level surfaces and dirt mounds. No burrowing owl indicators, such as white wash, feathers, or owl pellets, were evident at the inspected burrows. No indicators of San Joaquin kit foxes were observed. One lizard was observed, however the shape and coloration was not consistent with that of the blunt-nosed leopard lizard.

EcoBridges Environmental, accompanied by BSK, conducted a biological screening assessment on May 30, 2013 at the project site to assess habitat potential for special status wildlife species (Attachment 1). Wildlife species observed on, over, or near the project site by BSK and EcoBridges Environmental during the May 30 site reconnaissance included: American kestrel (*Falco sparverius*), mourning dove (*Zenaida macroura*), Western kingbird (*Tyrannus verticalis*), common raven (*Corvus corax*), cliff swallow (*Petrochelidon pyrrhonota*), European starling (*Sturnus vulgaris*), Western meadowlark (*Sturnella neglecta*), house finch (*Carpodacus mexicanus*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and California ground squirrel (*Otospermophilus beecheyi*). Canid scat (which also includes dogs) was also observed.

California ground squirrel burrows were noted to be common on the site, but not abundant during the May 30 site reconnaissance. There was no evidence the burrows were being used by other species, and most appeared unused. Four burrows had entrances of a suitable size and shape for San Joaquin kit fox, but in

each case the burrow narrowed quickly to a size that would preclude a kit fox, and there was no evidence of kit fox use of the site. There was no evidence of burrowing owls, but ground squirrel burrows and the concrete debris piles in the northeast corner of the site could provide potentially suitable dens. Three small, unidentified lizards were seen on-site, but they were not of suitable size, coloration, or shape to be blunt-nosed leopard lizards. A kangaroo rat precinct (circular burrow system) was detected along the northern border of the property. It was not apparently active, and the species to which it belonged could not be determined.

Plant species noted during site reconnaissance visits were primarily nonnative ruderal species. Special status plant species were not observed at the project site; however the winter of 2012-13 was a relatively dry water year, making the spring of 2013 less than optimal for plant growth. The presence of rare plant species, though not observed, cannot be excluded from the site. Plant species observed at the site included, but was not limited to: tumbleweed (*Salsola* sp.), wood-sorrel (*Oxalis* sp.), stork's bill (*Erodium* sp.), and mallow (*Malva* sp.).

Species Occurrence Data

The project site is located on the corners of the Delano West, Delano East, Pond, and McFarland U.S. Geological Survey (USGS) 7.5-minute topographical quadrangle maps (quads), primarily within the northeast corner of the Pond quad. Special status wildlife species observed within this four-quad area, and special status plant species within a nine-quad area - with the Pond quad in the center - were examined for potential to occur on the project site. The following table (1) Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area) includes the special status plant and wildlife species listed by the California Department of Fish and Wildlife (DFW) and United States Fish and Wildlife Service (USFWS) as occurring in or potentially affected by projects in the following U.S. Geological Survey (USGS) 7.5-minute topographical quadrangle maps (quads): Delano West, Delano East, Pond, and McFarland; and special status plant species listed by the California Native Plant Society as occurring in the following additional U.S. Geological Survey (USGS) 7.5-minute topographical quadrangle maps (quads): Allensworth, Wasco NW, Wasco SW, Wasco, and Famoso.

Conclusions

Factors considered in determining potential presence onsite included the habitat requirements of the species, the locations of the nearest recorded observances of the species, and the dates of the recorded observances of the species. Based upon these factors, best professional judgment was used to determine which species could be present onsite and should be considered for further analysis, such as pre-construction surveys. At the project site, the following special status species have been recorded near the site in recent years and the habitat onsite is suitable for the species; therefore, these species will be surveyed for during pre-construction surveys: American badger, San Joaquin kit fox, Tipton kangaroo rat, burrowing owl, and blunt-nosed leopard lizard. Although most of the special status plant species are considered unlikely to occur on or near the project site, the rare plant survey will identify these species if observed onsite. Therefore, all plants listed in the table below will be included in the rare plant survey.

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
Plants						
Alkali Mariposa Lily	*Calochortus striatus*	S2, 1B	Chaparral, chenopod scrub, Mojavean desert scrub, meadows and seeps; alkaline, mesic habitat. Bloom period is April – June.[ii]	Unlikely	Habitat at the site is not typical habitat for this species, and CNDDB does not map this species within five miles of the site. It is unlikely that the alkali mariposa lily would be present. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Brittlescale	*Atriplex depressa*	S2, 1B	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools; alkaline, clay habitat. Bloom period is April – October.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that brittlescale would be present. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
California Jewel-flower	*Caulanthus californicus*	FE, CE, S1, 1B	Chenopod scrub, pinyon and juniper woodland, valley and foothill grassland; sandy habitat. Bloom period is	Unlikely	CNDDB maps an occurrence of this plant within one and a half miles of the site in 1936; however, a site revisit in 1986 found the occurrence extirpated and habitat eliminated due	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			February – May.		to agricultural and urban development. It is unlikely that the California jewel-flower would be present onsite. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	
Crownscale	*Atriplex coronata* var. *coronata*	S3, 4	Chenopod scrub, valley and foothill grassland, vernal pools; alkaline, often clay habitat. Bloom period is March – October.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that crownscale would be present. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Earlimart Orache	*Atriplex cordulata* var. *erecticaulis*	S2, 1B	Valley and foothill grassland. Bloom period is August – November.	Possible	CNDDB maps occurrences of this plant within two miles of the site in 1985 and 1989. It is possible that the Earlimart orache would be present onsite.	Yes
Heartscale	*Atriplex cordulata* var. *cordulata*	S2, 1B	Chenopod scrub, meadows and seeps, valley and foothill grassland (sandy); saline or alkaline	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that heartscale would be present. However, because a rare plant survey is being conducted for	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			habitats. Bloom period is April – October.		the site, this plant will be included in the biological analysis.	
Kern Mallow	*Eremalche kernensis*	FE, S2, 1B	Chenopod scrub, valley and foothill grassland. Bloom period is March – May.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that the Kern mallow would be present onsite. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Lesser Saltscale	*Atriplex minuscula*	S2, 1B	Chenopod scrub, playas, valley and foothill grassland; alkaline, sandy habitats. Bloom period is May – October.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that lesser saltscale would be present. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Lost Hills Crownscale	*Atriplex coronata* var. *vallicola*	S2, 1B	Chenopod scrub, valley and foothill grassland, vernal pools; alkaline habitats. Bloom period is April – August.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that the Lost Hills crownscale would be present. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
Munz's Tidy-tips	*Layia munzii*	S1, 1B	Chenopod scrub, valley and foothill grassland; alkaline clay soils. Bloom period is March – April.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that Munz's tidy-tips would be present onsite. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Recurved Larkspur	*Delphinium recurvatum*	S3, 1B	Chenopod scrub, valley and foothill grassland, cismontane woodland; alkaline soils. Bloom period is March – June.	Possible	CNDDB maps occurrences of this plant within five miles of the site in 1958, 1973, and 1993. It is possible that the recurved larkspur would be present onsite.	Yes
Slough Thistle	*Cirsium crassicaule*	S2, 1B	Chenopod scrub, marshes and swamps (sloughs), riparian scrub. Bloom period is May – August.	Unlikely	Habitat at the site is not typical habitat for this species, and CNDDB does not map this species within five miles of the site. It is unlikely that slough thistle would be present onsite. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	Yes
Subtle Orache or Deltoid Bract	*Atriplex subtilis*	S2, 1B	Valley and foothill grassland. Bloom period is June – October.	Unlikely	CNDDB does not map this species within five miles of the site. It is unlikely that the subtle orache would	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
Saltbrush					be present onsite. However, because a rare plant survey is being conducted for the site, this plant will be included in the biological analysis.	
Mammals						
American Badger	*Taxidea taxus*	SSC, S4	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats; needs sufficient food, friable soils and open, uncultivated ground; preys on burrowing rodents; digs burrows.[iii]	Possible	Closest CNDDB record is within ten miles of the site. The site provides highly suitable habitat for reproduction, shelter, and foraging. Therefore, it is possible the American badger would occur onsite.	Yes
Dulzura California Pocket Mouse	*Chaetodipus californicus femoralis*	SSC, S2?	Dense, shrubby habitat, especially chaparral.[iv]	Unlikely	Habitat at the site is not typical habitat for this species. The closest CNDDB record is approximately ten miles from the site. It is unlikely that the Dulzura California pocket mouse would be present onsite.	No
San Joaquin Kit Fox	*Vulpes macrotis mutica*	FE, CT, S2S3	Grassland and scrubland, including land heavily modified	Possible	CNDDB maps several occurrences of this species to within five miles of the site; the most recent in 2005. The site	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			(for example, by crops or irrigated pastures); oak woodland, vernal pools and alkali meadows.[v]		provides highly suitable habitat for reproduction, shelter, and foraging. It is possible that the San Joaquin kit fox would occur onsite.	
San Joaquin Pocket Mouse	*Perognathus inornatus inornatus*	S2S3	Dry, open grassland or scrub, fine soils for burrows.[vi]	Unlikely	The site provides highly suitable habitat for reproduction, shelter, and foraging; however, CNDDB does not map this species within five miles of the site. It is unlikely San Joaquin pocket mouse would occur onsite.	No
Tipton Kangaroo Rat	*Dipodomys nitratoides nitratoides*	FE, CE, S1	Saltbrush scrub and sink scrub habitat, alluvial fan and floodplain soils for burrows, prefers sparse-to-moderate shrub cover. [vii]	Possible	CNDDB maps this species to within two miles of the site in 1985; last updated in 1998 and presumed extant. The site provides moderately suitable habitat for reproduction and cover and highly suitable habitat for foraging. It is possible for Tipton kangaroo rat to occur onsite.	Yes
Birds						
Burrowing Owl	*Athene cunicularia*	FSC, SSC, S2	Burrow sites occur in open, dry annual or perennial grasslands,	Possible	CNDDB has mapped this species to within five miles of the site. Habitat at the project location is suitable for use	Yes

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			deserts, and scrublands characterized by low-growing vegetation; subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.[viii]		by this species. The site survey found numerous California ground squirrel burrows but no signs characteristic of burrowing owl activity. Therefore, it is possible that burrowing owls would be present at the project location.	
Fish						
Delta Smelt	*Hypomesus transpacificus*	FT, CE, S1	Brackish to freshwater, depending on life stage. Current range from the Suisun Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties.[ix]	Unlikely	CNDDB does not map this species within five miles of the site; and habitat does not exist on site. Therefore, it is unlikely Delta smelt would be present onsite.	No
Kern Brook Lamprey	*Entosphenus hubbsi*	SSC, S1S2	San Joaquin River system and Kern River; gravel-bottomed areas for spawning and muddy-bottomed areas	Unlikely	CNDDB maps this species within five miles of the site; however, habitat does not exist on site. Therefore, it is unlikely Kern brook lamprey would be present onsite.	No

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			where the species can burrow and feed.[x]			
Amphibians and Reptiles						
Blunt-nosed Leopard Lizard	*Gambelia sila*	FE, CE, S1, FP	Open, sparsely vegetated alkali and desert scrub habitats with low topographic relief; seeks cover in mammal burrows, under shrubs, and under structures.[xi] [xii]	Possible	CNDDB has mapped this species to within five miles of the site. Habitat at the project location is moderately suitable for use of this species. Therefore, it is possible blunt-nosed leopard lizard would occur onsite.	Yes
California Red-legged Frog	*Rana draytonii*	FT, SSC, S2S3	Still, permanent bodies of freshwater, such as ponds, lakes, marshes, or slow flowing sections of creeks and streams. Traverse through, grasslands, riparian woodlands, oak woodlands, and coniferous forests.[xiii]	Unlikely	CNDDB does not map this species within five miles of the site; and habitat does not exist on site. Therefore, it is unlikely California red-legged frog would be present onsite.	No
Blainville's (formerly	*Phrynosoma blainvillii*	SSC, S3S4	Open areas of sandy soil and low vegetation in	Unlikely	CNDDB does not map this species within five miles of the site. The site	No

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
Coast) Horned Lizard			valleys, foothills and semiarid mountains.[xiv]		provides moderately suitable habitat for species reproduction, shelter, and foraging. However the site is outside the geographic range of the species. Therefore, it is unlikely Blainville's horned lizard would be present onsite.	
Giant Garter Snake	*Thamnophis gigas*	FT, CT, S2S3	Marshes, sloughs, ponds, small lakes, low gradient streams, drainage canals, and irrigation ditches, especially around rice fields. Prefers locations with vegetation close to the water for basking.[xvxvi]	Unlikely	CNDDB does not map this species within five miles of the site; and habitat does not exist on site. Therefore, it is unlikely giant garter snake would be present onsite.	No
San Joaquin Coachwhip (Whipsnake)	*Masticophis flagellum ruddocki*	SSC, S2?	Grass, desert, scrub, chaparral, and pasture habitats. Needs mammal burrows for refuge and egg-laying.[xvii]	Unlikely	CNDDB does not map this species within five miles of the site. The 1994 CDFG distribution map of this species indicates that the species is presumed extinct in the area around Delano.[xviii] Therefore, it is unlikely San Joaquin coachwhip would be present onsite.	No

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
Western Spadefoot Toad	*Spea hammondii*	SSC, S3	Grasslands with shallow temporary pools; vernal pools are essential for breeding and egg-laying.[xix]	Unlikely	CNDDB does not map this species within five miles of the site. The site provides suitable habitat for species shelter, and foraging. However, no wetlands or waterways were observed at or directly adjacent to the site during the site survey. Therefore, it is unlikely Western spadefoot toad would be present onsite.	No
Invertebrates						
Conservancy Fairy Shrimp	*Branchinecta conservatio*	FE, S1	Large, turbid vernal pools and vernal swales.[xx]	Unlikely	CNDDB does not map this species within five miles of the site; and suitable habitat does not exist on site. It is unlikely conservancy fairy shrimp would be present onsite.	No
Hopping's blister beetle	*Lytta hoppingi*	S1S2	Foothills at the southern end of the Central Valley. There have been insufficient studies to corroborate specific habitat requirements.[xxi]	Unlikely	The CNDDB has mapped this species to within two miles of the site. Little information is available about species habitat; however, *Lytta* larvae are nest parasites of solitary bees which typically nest in well-drained soil with little organic matter.[xxii] Soil conditions at the project site do not favor solitary bee nesting; therefore, it	No

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
					is unlikely that Hopping's blister beetle is present onsite.	
Molestan blister beetle	*Lytta molesta*	S2	Central California from Kern County to Yolo County. Annual grasslands. Thought to be dependent on dried vernal pool habitats, but there have been insufficient studies to corroborate specific habitat requirements.[xxiii]	Unlikely	The CNDDB does not map this species within five miles of the site; though the site is within the general geographic range of the species. Little information is available about species habitat requirements; however, *Lytta* larvae are nest parasites of solitary bees which typically nest in well-drained soil with little organic matter. Soil conditions at the project site do not favor solitary bee nesting; therefore, it is unlikely molestan blister beetle would be present onsite.	No
Valley Elderberry Longhorn Beetle	*Desmocerus californicus dimorphus*	FT, S2	Riparian habitats and associated upland habitats where elderberry (*Sambucus* spp.) grows.[xxiv]	Unlikely	CNDDB does not map this species within five miles of the site; and suitable habitat does not exist onsite. It is unlikely valley elderberry longhorn beetle would be present onsite.	No
Vernal Pool Fairy Shrimp	*Branchinecta lynchi*	FT, S2S3	Vernal pools and swales, alkali pools, seasonal drainages,	Unlikely	CNDDB does not map this species within five miles of the site; and suitable habitat does not exist onsite.	No

Table 1 Special Status Species Listed by DFW and USFWS as Occurring Near the Project Area

Common Name	Scientific Name	Status[i]	Habitat	Potential Presence Onsite	Rationale	Included in Analysis
			stock ponds.[xxv]		It is unlikely vernal pool fairy shrimp would be present onsite.	

Notes:
CNDDB: California Natural Diversity Database
FE – Federal Endangered
FT – Federal Threatened
FP – California Fully Protected
CE – California Endangered
CT – California Threatened
SSC – California Species of Concern
S1 – CNDDB State Ranking = Critically Imperiled
S2 – CNDDB State Ranking = Imperiled
S3 – CNDDB State Ranking = Vulnerable
S4 – CNDDB State Ranking = Apparently Secure
S#S# – CNDDB State Ranking is uncertain and ranges between the two numbers
S#? – CNDDB State Ranking is less certain than the given number, but is more certain than the next number range
1B – California Native Plant Society (CNPS) Rare Plant Rank for plants that are rare, threatened or endangered in California and elsewhere
4 – California Native Plant Society (CNPS) Rare Plant Rank for plants that have a limited distribution

[i] DFW Special Animals list used for wildlife species status; Special Vascular Plants, Bryophytes, and Lichens List used for plant species status.
[ii] Plant species habitats and blooming periods obtained from CNPS.org (California Native Plant Society)
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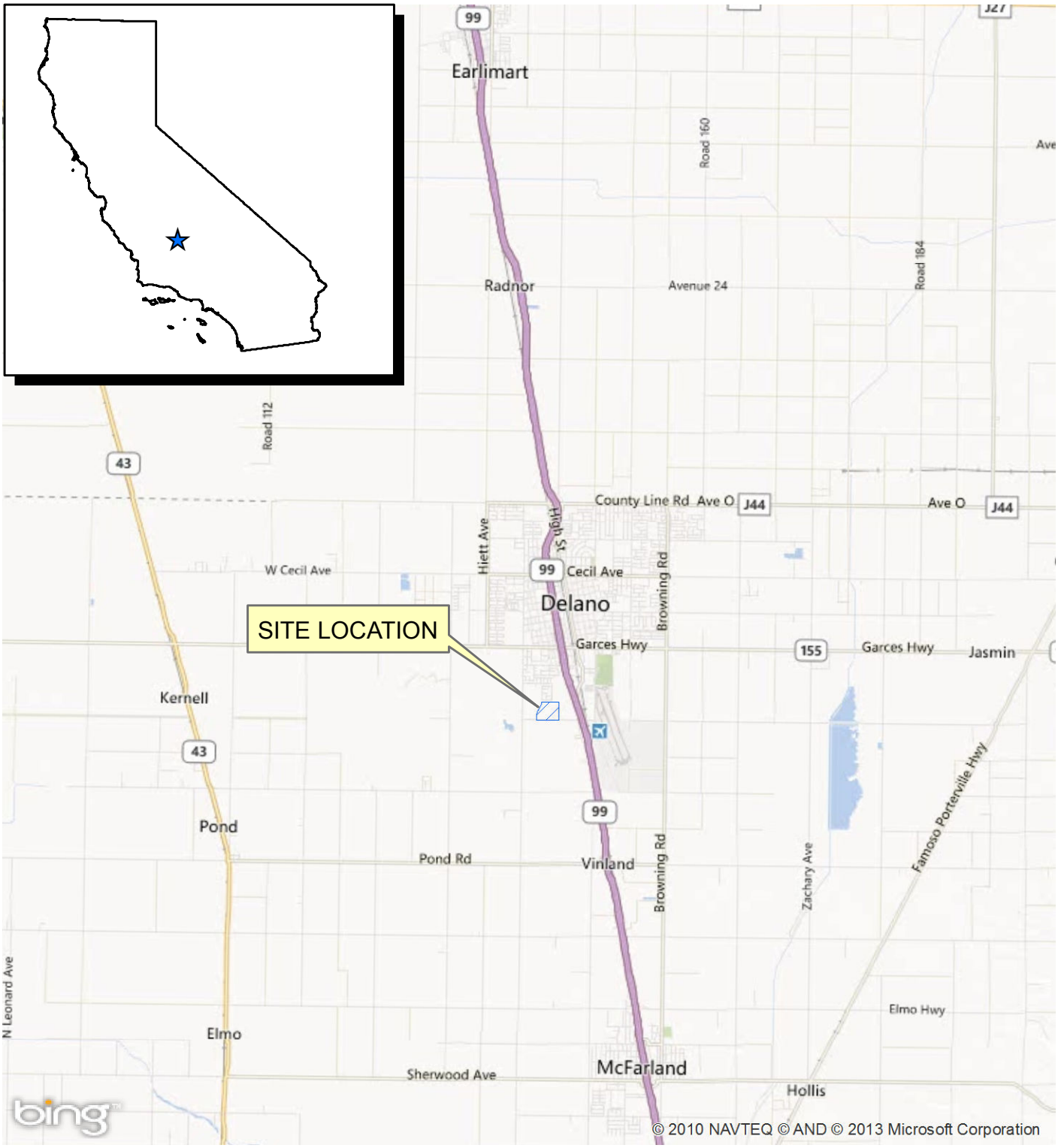

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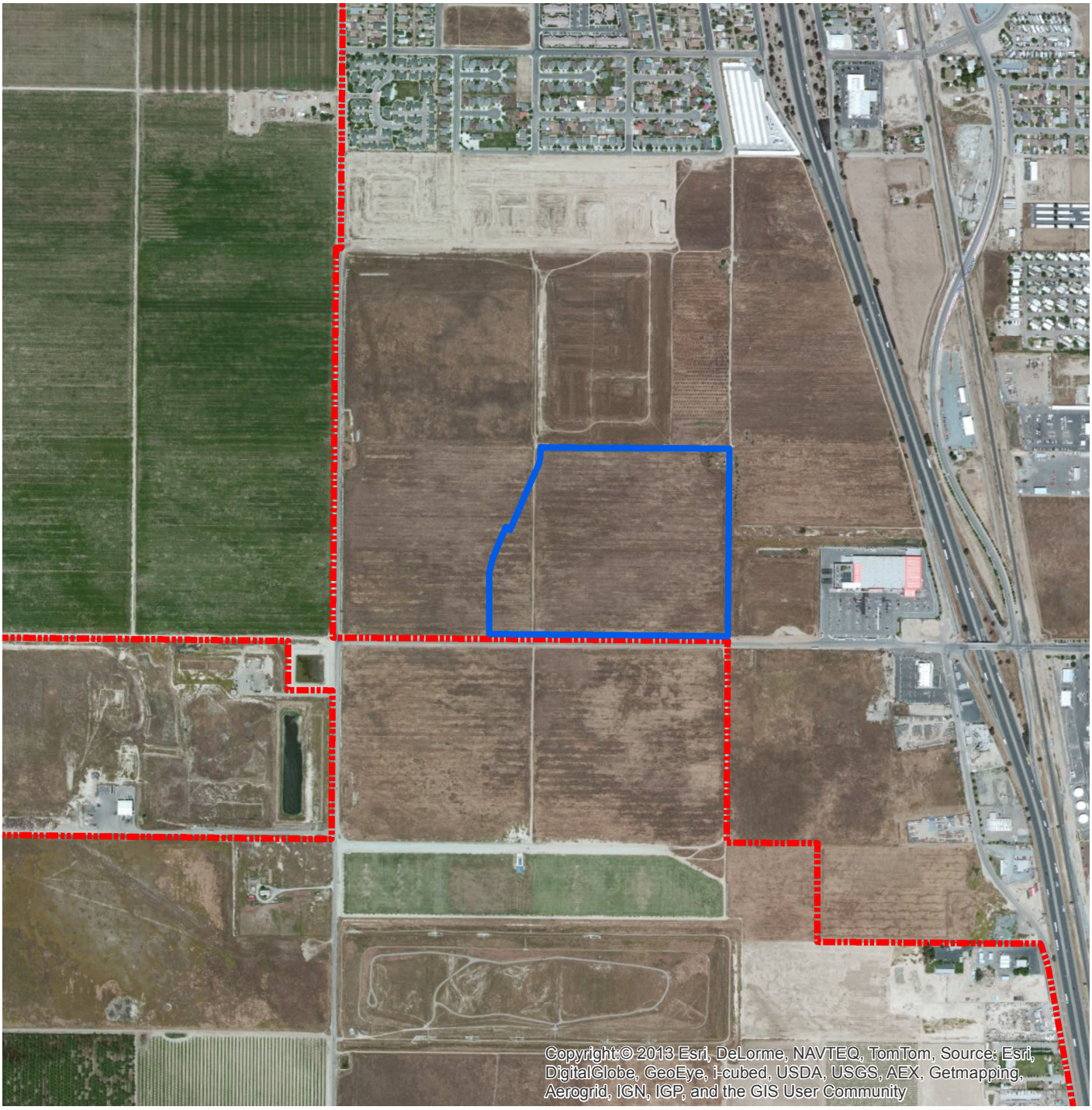
The Grapevine Project NW Corner of Woollomes and S. Dover Delano, California	**FIGURE 1** **VICINITY MAP** **BSK Project E1300901S**



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Site Area

Delano City Limits

The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

FIGURE 2
SITE AREA
BSK Project E1300901S

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Plate 1: Taken from southern end of site, looking northeast.

Plate 2: Taken from eastern end of site, looking northeast.

	FIGURE 3.1-1 SITE PHOTOGRAPHS **GRAPEVINE SHOPPING CENTER** DELANO, CALIFORNIA	FIGURE 1 of 3
		PROJECT: E1300901S

Plate 3: Example of California ground squirrel burrows present at the site.

Plate 4: Example of mounds present at site.

	FIGURE 3.1-1 SITE PHOTOGRAPHS **GRAPEVINE SHOPPING CENTER** DELANO, CALIFORNIA	FIGURE 2 of 3
		PROJECT: E1300901S

Plate 5: Debris pile at northwest corner of site.

Plate 6: Area of former residence at northeast corner of site, looking southwest.

	FIGURE 3.1-1 SITE PHOTOGRAPHS **GRAPEVINE SHOPPING CENTER** DELANO, CALIFORNIA	FIGURE 3 of 3
		PROJECT: E1300901S

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M E M O R A N D U M

To: Erik Ringelberg/BSK Associates

From: Anne Wallace/EcoBridges Environmental

Date: June 17, 2013

Re: Biological screening assessment, Delano Grapevine Project, Delano, CA

EcoBridges Environmental senior biologist Anne Wallace was retained by BSK Associates to conduct a screening-level wildlife survey of the site of the Delano Grapevine project in Delano, California. Also called the Delano Marketplace project and described in detail elsewhere, the project would entirely develop 45 acres at the southwest corner of Woollomes Avenue and Garzoli Avenue, near the intersection of State Route 99 and Woollomes Avenue. The wildlife survey was conducted on May 30, 2013, to assess habitat potential for the state and federally endangered and California fully protected blunt-nosed leopard lizard (*Gambelia sila*), the state threatened and federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*), the state and federally endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), the state threatened Nelson's antelope squirrel (*Ammospermophilus nelsoni*), and the California species of special concern burrowing owl (*Athene cunicularia*).

Methods

Ms. Wallace employed a variable-effort pedestrian survey of the perimeter and interior of the site looking for the animals themselves, as well as suitable burrows and evidence of burrow use for the species named above. Notes were taken on species and habitat features observed. While the site visit was intended to be a screening-level field investigation, and not a formal protocol survey for any species, air and soil temperatures did fall within the range best suited for detecting blunt-nosed leopard lizard. A record search of the California Natural Diversity Database (CNDDB) was conducted for 12 quads surrounding the project site (CDFW 2013).

Results

At the time of the visit, the site was dry, degraded, and supported primarily nonnative grasses and a relatively heavy cover of dead Russian thistle (*Salsola kali*), or tumbleweeds. The site had been tilled, possibly within the last year. The extreme northeast corner of the site supported a few small tree of heaven (*Ailanthus altissima*) trees with a single larger tree of unknown species. Concrete debris and human trash were scattered throughout this small area.

California ground squirrels (*Otospermophilus beecheyi*) and their burrows were seen throughout the site. They were common but not abundant, perhaps because of recent tilling. There was no evidence of use by other species at any of these burrows, and many appeared unused. Four burrows had entrances of a suitable size and shape for San Joaquin kit fox, but in each case the burrow narrowed quickly to a size that would preclude a kit fox and there was no evidence of kit fox use of the site. There was no evidence of burrowing owls, but ground squirrel burrows and the concrete debris piles in the northeast corner of the site provide potentially suitable dens. Three small, unidentified lizards

were seen on site, but they were not of suitable size, coloration, or shape to be blunt-nosed leopard lizards. The presence of blunt-nosed leopard lizard cannot be ruled out, but it was not detected. A single, isolated pole in the northeast corner of the site contains a cavity near the top with evidence of bird use (whitewash). No bird was seen using the cavity, but it is not expected to be supporting a special-status species.

A kangaroo rat precinct was detected just south of the dirt road that runs east to west along the northern border; the precinct was located roughly midway between the eastern and western boundaries. It was not apparently active, but current occupation could not be ruled out, and the species to which it belonged could not be determined. Tipton kangaroo rat occurs in arid-land plant communities occupying the floor of the Tulare Basin in Tulare and Kern counties (US Fish and Wildlife Service 2010) and could potentially occur on site. The CNDDB contains a number of records for this species within 5 to 10 miles of the site.

Nelson's antelope squirrel also occurs in arid-land plant communities of the southern San Joaquin Valley and could potentially occur on site. Most occurrences of this squirrel are farther west in the San Joaquin Valley, closer to and west of I-5 (US Fish and Wildlife Service 1998); however, the CNDDB contains five occurrence records for this species in the 12-quad search area from 1988 and 1991 (CDFG 2013).

Recommendations

The following measures are recommended:

1. The status of the kangaroo rat precinct should be determined by a qualified biologist. If it is actively supporting Tipton's kangaroo rat, the US Fish and Wildlife Service should be consulted for further guidance.
2. A preconstruction survey should be conducted by a qualified biologist within 14 days of ground-disturbing activities associated with project construction. State and federal agencies should be consulted on the presence of any special-status species with construction postponed until agency consultation is resolved.

Incidental Observations

The following species were seen or heard on, over, or near the project site during the site visit:

Unidentified lizard – three individuals
American kestrel (*Falco sparverius*)
Mourning dove (*Zenaida macroura*) - one nest found, another inferred
Western kingbird (*Tyrannus verticalis*)
Common raven (*Corvus corax*)
Cliff swallow (*Petrochelidon pyrrhonota*)
European starling (*Sturnus vulgaris*)
Western meadowlark (*Sturnella neglecta*)
House finch (*Carpodacus mexicanus*)
Desert cottontail (*Sylvilagus audubonii*)
Black-tailed jackrabbit (*Lepus californicus*)
California ground squirrel (*Otospermophilus beecheyi*)
Unidentified kangaroo rat – precinct
Coyote/fox - canid scat

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APPENDIX 3.5

CULTURAL STUDIES

A CULTURAL RESOURCES ASSESSMENT FOR 77.27 ACRES IMMEDIATELY NORTH OF WOOLLOMES AVENUE AND IMMEDIATELY EAST OF STRADLEY AVENUE IN DELANO, KERN COUNTY, CALIFORNIA

Prepared by:

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Three Girls and a Shovel
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TG&S Job #080524
Work Order: Delano 1

Prepared for:

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Key words: Kern County, City of Delano, McFarland (1954, 1969), Pond (1953, 1969), Delano East (1953, 1969), Delano West (1954, 1969) 7.5'series topo maps, T. 25 S., R. 25 E., Phase I (survey), Stradley Ave., Woollomes Ave., vacant acreage

August 2005

KE- 03105

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EXECUTIVE SUMMARY

At the request of M.H. Wolfe *and Associates* Three Girls and a Shovel, LLC (TG&S) of Bakersfield, California conducted a cultural resources assessment on 77.27 acres immediately north of Woollomes Avenue and immediately east of Stradley Avenue in Delano, Kern County, California. The purpose of the archaeological assessment was to satisfy the requirements of the California Environmental Quality Act (CEQA) regarding identification and protection of cultural resources.

The project area was surveyed in August 2005. No cultural resources were located as a result of the pedestrian survey and no further archaeological work is recommended for this project area. However, it is worth mentioning that a month prior to the archaeological survey two houses, believed to have been built prior to 1940, were bulldozed and then burned. No artifactual remains were located in the area of the houses, probably due to the bulldozing before the burning. What remains today is foliage; these are trees and bushes associated with people and homes.

The following procedures must be followed:

1) **If unrecorded cultural resources are located during utilization of this property, work must halt in the vicinity and the finds must be assessed by a qualified archaeologist.**

2) **If human remains are discovered at any time on this property, work must halt in the area of the find and the Kern County Coroner must be notified immediately (Health and Safety Code Section 7050.5).**

INTRODUCTION

At the request of M.H. Wolfe *and Associates* ENVIRONMENTAL CONSULTING INC., a cultural resources assessment was conducted by Three Girls and a Shovel, LLC, 2820 Alta Vista Drive, Bakersfield, California, on 77.27 acres immediately north of Woollomes Avenue and immediately east of Stradley Avenue in Delano, California. The purpose of this assessment was to satisfy requirements of the California Environmental Quality Act (CEQA) for the identification and protection of cultural resources.

PROJECT LOCATION AND DESCRIPTION

The project area is located in Delano, east of Stradley Avenue and north of Woollomes Avenue. The project area is bordered on the north by a field of sunflowers, on the west by Stradley Avenue, on the east by an unnamed dirt road and on the south by Woollomes Avenue. Specifically, the project area is located in the SW ¼ of the SW ¼ of Section 14, T. 25 S., R. 25 E., MDBM, as shown on the McFarland (1954, 1969), Pond (1953, 1969), Delano East (1953, 1969) and Delano West (1954, 1969) 7.5' series USGS topographic maps (Figure 1). The exposure is open, the property is flat and lies at an elevation of about 295' AMSL. The project area is currently unused and has been disked to alleviate weeds. Wildlife (snake, lizards, ground squirrels and lagamorphs) was observed in the area. Vegetation was disked and consisted of grasses, old and laid-over. Visibility overall was good, approximately 80 to 95 percent.

RECORDS SEARCH

A records search (Appendix I) was conducted at the Southern San Joaquin Valley Information Center. The records search indicated that there have been no previous cultural resources studies conducted within the project area or are there any recorded cultural resources. There have been no surveys conducted within the survey area, two surveys conducted immediately adjacent, four surveys within a half-mile radius and three surveys within a one-mile radius of the project area. There are no known cultural resources within the project area or within a one-half mile radius that are listed in the National Register of Historic Places, the California Register, California Inventory of Historic Resources, California Points of Historic Interest, or the California State Historic Landmarks.

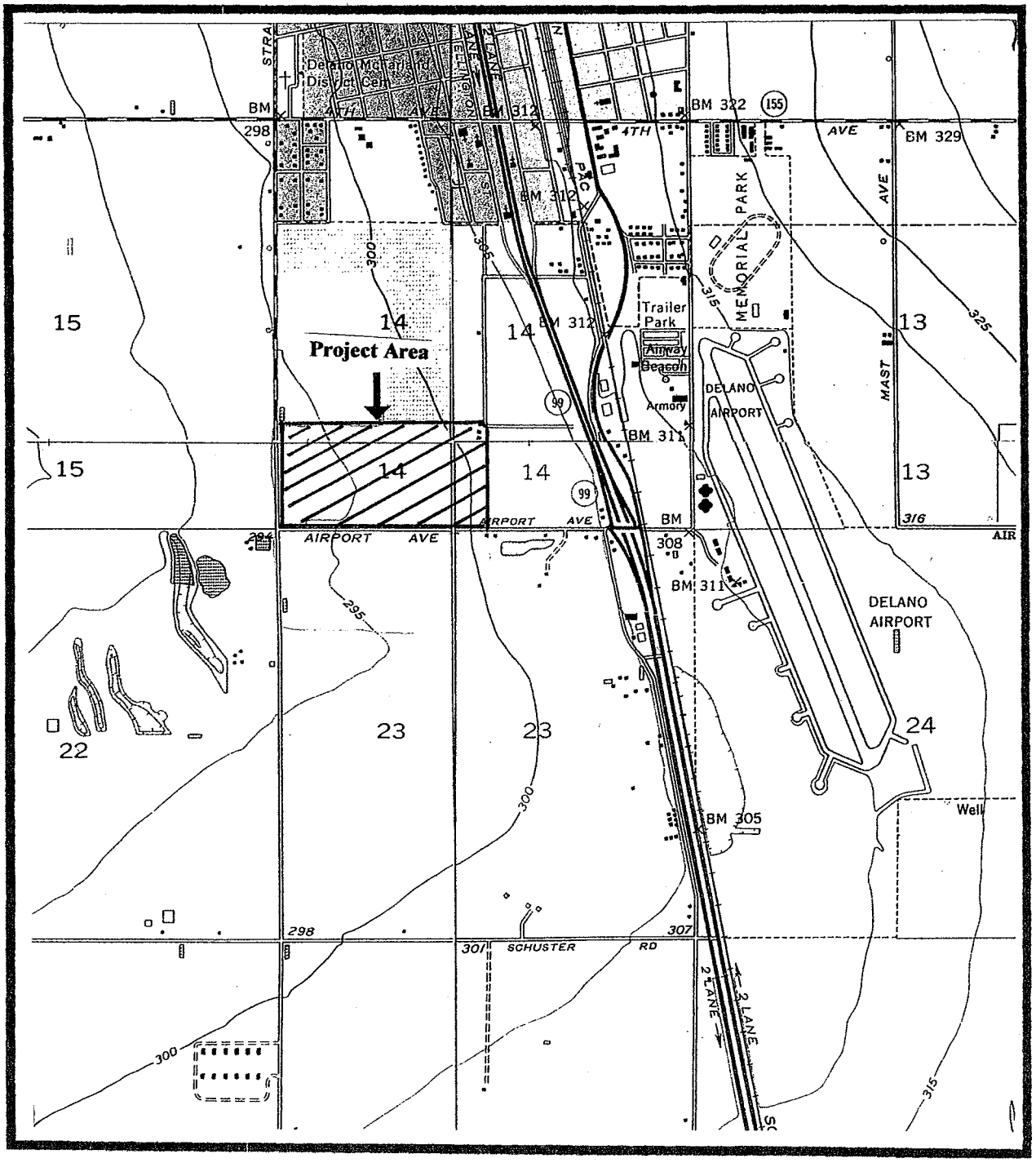

Figure 1. Project area and survey location as shown on the McFarland (1954, 1969), Pond (1953, 1969), Delano East (1953, 1969) and Delano West (1954, 1969) 7.5' series USGS topographic maps.

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PREHISTORIC ENVIRONMENTAL SETTING

A recounting of the prehistoric environment of California and the San Joaquin Valley is presented in Michael J. Moratto's "California Archaeology" (1984). The following is excerpted and paraphrased from that source.

The pre-contact Native Americans were completely reliant upon their natural resources. They had extensive knowledge about habitats and animals, plants, climate, rocks, and minerals. They knew how to place villages to maximize the environmental surroundings. Their cultures were strongly influenced by natural conditions and it is necessary to understand California's environmental setting to understand the pre-historic inhabitants and interpret the later archaeological record.

California covers approximately 157,207 square miles and includes many geomorphic provinces. With such a large area, including a long coastline, mountains, and deserts, there is great variety and contrast in the state's physiography, geology, climate, flora, and fauna. Of special concern here is the Great Central Valley, consisting of the Sacramento Valley, the Delta, and the San Joaquin Valley.

The floor of the valley is 750 km long and 30-80 km wide and is enclosed by the Siskiyou, Sierra Nevada, Tehachapi, and Coast Mountain ranges. It is underlain, mainly, by Sierran stream sediments up to 17 km deep. Elevation ranges from sea level to 100 m AMSL, broken only by the 600 m high Sutter Buttes. The Sacramento and San Joaquin River systems drain the valley and merge into the channels and marshes of the Sacramento-San Joaquin Delta. The waters later pass through a gap in the Coast Range and empty into San Pablo Bay.

Over the centuries the valley experienced many dramatic environmental changes, including: faunal extinctions and replacement at the end of the Pleistocene, the emergence of wetlands, flooding, massive siltation, cyclical appearance and evaporation of shallow lakes, and biogeographic shifts in response to climatic fluctuations.

In ancient times lakes, marshes, and sloughs covered more than 5,000 square km in the San Joaquin Valley alone. The largest lake, Tulare, occupied a structural basin created by down warping. Additionally, Tulare and Buena Vista Lakes were partially contained by alluvial fans reaching into the valley from the King's River and Los Gatos Creek. These coalesced into a ridge and lands to the south were so arid that runoff was often not able to maintain a discharge through the alluvium. This natural dam thus contributed to the impoundment of Tulare Lake and its swampy basin. A similar projection from the Kern River fan westward to the McKittrick

Hills formed a second dam behind which lie Kern and Buena Vista Lakes. At flood levels the Buena Vista and Tulare Lakes spilled into a single basin and with the waters of the Kern, Kaweah, and King's Rivers, flowed into the San Joaquin River system. The lakes are now mostly dry due to historic drainage projects.

The Central Valley was attractive to the early inhabitants. The climate was locally varied, but generally pleasant. Precipitation was also variable and in the southern San Joaquin Valley, where it was scant, the water was supplemented by the snowmelt from the mountains. The Central Valley's plains and wetlands had abundant game and vegetal foods. The bottomlands produced lush swamp vegetation valued for food, fiber, and building materials. Riparian woodlands grew along the watercourses. The waterways also provided the habitats for river mussels and many species of fish. Steatite and asphaltum occurred in the southern part of the valley and salt deposits were found in the north. With so many abundances, resources that were lacking, such as obsidian, were easily obtainable through trade with outside areas. With such an abundance of resources and comfortable living conditions, the eighteenth century aboriginal population was 105,000, with 53,000 people in the Sacramento Valley and 52,000 in the San Joaquin.

During the long prehistory of the Central Valley there have been diverse and changing environments, along with many population movements, waves of cultural influences from neighboring groups, and a complex interplay between local and regional cultural forces. The oldest evidence for occupation of the valley comes from Tracy, Tulare, and Buena Vista Lakes and dates to about 11,500-7,500 years ago. Since the floor of the valley is covered with a thick layer of alluvium, it is likely that most of the earliest habitation evidence lies buried beneath it. This would account for the modest antiquity of artifacts, especially in the valley lowlands of the San Joaquin and Sacramento River drainages. In these areas 10-m of sediments have accumulated just during the past 5,000-6,000 years.

ETHNOGRAPHY

SOUTHERN VALLEY YOKUTS

The Yokuts have been broken into three geographical divisions, the Northern, Foothill, and Southern Valley Yokuts. The project area lies within the territory of the Southern Valley Yokuts. William J. Wallace (1978) excerpts the following information from "Southern Valley Yokuts".

The territory of the Southern Valley Yokuts included Tulare, Buena Vista, and Kern Lakes, their connecting sloughs, and the lower portion of the Kings, Kaweah, Tule, and Kern Rivers. The area consisted of extensive swamps and marshlands that provided an enormous variety and abundance of wildlife and aquatic flora. The southern San Joaquin Valley received only 5-10 inches of rain annually and was dependent upon the additional water being brought in from the melting snows of the Sierra Nevadas. As the Yokuts adapted to this abundance of subsistence resources they developed a culture of comparatively greater material wealth and tended to live in large, more permanent settlements. It is estimated that this way of life lasted approximately 2,000 years. At the beginning of the historic period 15 different Yokuts groups were identified in the area.

Adapting to their environment, the southern Valley Yokuts developed a mixed economy subsistence pattern. It emphasized fishing, hunting waterfowl, and collecting shellfish, roots, and seeds. Most of their region was treeless except for the cottonwoods, sycamores, and willows that lined the river channels and sloughs. Oaks did not extend very far onto the valley floor and, therefore, acorns were not readily available. They were generally obtained by trade with neighboring groups.

Small land mammals and birds were only a small portion of the native diet and the Southern Valley Yokuts rarely ventured into the open country to capture antelope and elk. They did, however, capture many of the larger mammals when they came to the lakes and sloughs for water.

Various cooking methods were employed. Tule roots and seeds were ground into meal, mixed with water, and stone-boiled in baskets. Fish and meat were broiled and roasted on coals and ashes. Small earth ovens were used to bake both vegetable and animal foods. Salt grass was used for seasoning. Firewood was at a premium and dried tules were usually substituted.

Single family residences were constructed by using long poles, limbs, or sticks with one end set on the ground in an oval pattern, and the other ends brought together at the top to form a

frame that was then covered with mats made from tule reeds. Some groups, using the same materials, built a distinctive long, steep-roofed communal house. This structure would shelter ten or more families. Each family would have a fireplace and outside door. Along the front of the house a long open shade porch was constructed and many of the domestic activities, such as cooking, were performed there. Additionally, each village had a communally owned sweathouse. The men did their daily sweating and occasionally slept there.

Clothing worn by the Southern Valley Yokuts was minimal. Males were either naked or used a breechcloth. Females wore a narrow fringed apron in front and a larger back piece. In cold weather both sexes wrapped themselves in skin cloaks. Generally feet were bare, though simple skin moccasins were used when traveling over rocky, brushy terrain. The hair was worn long by men and women and held in place by a string tied around the forehead. Women, who bore the heaviest burdens, wore basketry caps to protect the forehead from the tumpline band when carrying heavy burdens. Men carried loads in net backpacks held by a chest strap. Mainly women wore simple design tattooing. The design consisted of lines, zigzags, and rows of dots down the chin and across from the corners of the mouth. Children had their earlobes and nasal septa pierced for insertion of an ornament.

The Yokuts technology was also shaped by the source of raw materials available. The very important tule provided the basis for their highest technological skill - basket weaving. The baskets varied in shape and use and included bowl-shaped cooking containers, conical burden baskets, flat winnowing trays, seed beaters, and a unique necked water bottle. Wood and stone crafts were quite undistinguished. Wood and many lithic materials were imported. Stone mortars and pestles were obtained by trade. Marine shells were secured from trade with coastal peoples and used for currency and personal adornment.

Canoe-shaped rafts were constructed of dried tules and constituted the Yokuts favored mode of travel. The rafts could hold six people and their belongings.

The basic domestic and economic unit in southern Valley Yokuts society was the nuclear family. The families were grouped into patrilineal totemic lineages. A totem, an animal or bird, was a symbol representing the father's line. The totem was dreamed about, prayed to, and forbidden to kill or eat by that lineage. The lineage was a mechanism for transmitting offices, performing certain ceremonial duties, and creating mutual loyalties. These lineages were further organized into two moieties, or groups. The moieties had little to do with day-to-day life, but did serve certain functions. They would serve as opposing teams for games and as reciprocal groups in mourning rites and first fruits ceremonies. Moiety exogamy was customary, but not absolute.

There was no overall political unity among the tribes. They were split into self-governing local groups. Each group had a name, spoke a different dialect, and had a territory that was collectively owned. Some official positions were filled through patrilineal inheritance. In the Tachi tribe each settlement had a chief for each moiety and the pair shared equal authority.

Generally Yokuts groups were peaceful, but occasional warfare did break out. Fighting was on a small scale and very little ritual was attached to warfare.

There were four occasions regarded as significant and crucial in the life of each Yokuts: birth, a girl's puberty, marriage, and death. Each of these periods required special care, attention, and ceremony.

One of the most important ceremonies was the ritual honoring the tribal dead. This usually took place annually, lasted six days, and included outside local groups. Guests came by the hundreds for the festival. The shamans were the only religious specialists of the Yokuts. They also served as "doctors."

Many rituals were accompanied by songs and instrumental music. Musical instruments included the cocoon rattle, bone and wood whistle, flute, musical bow, and a cleft-stick rattle. The major artistic accomplishment of the Southern Valley Yokuts was the decorative patterns woven into their baskets.

No significant number of Southern Valley Yokuts came under the control of the coastal Franciscan missionaries; however, significant impact to their culture resulted from infiltration of escaped natives from the missions. The runaways introduced foreign practices from their cultures which had suffered greatly from non-practice and practices acquired from the missions. Complete cultural breakdown and near-total disappearance of native peoples from the San Joaquin Valley came with the annexation of California by the United States. The land passed quickly into the hands of the settlers. The process was relatively easy since the native peoples offered little effective resistance.

Because of the early and rapid decimation of the Southern Valley Yokuts and the rapid collapse of their culture, there is relatively little published literature regarding them, and ethnographic descriptions obtained from aged informants is certainly incomplete.

FIELD PROCEDURE

Dorothy Fleagle and Catherine Pruett conducted a pedestrian survey of the project area August 13, 2005 (See Appendix II for qualifications of personnel). Transects were walked in an east/west direction; transects were spaced 25 to 30 meters apart. Visibility was estimated to be between 80 and 95 percent.

RESULTS AND RECOMMENDATIONS

No cultural resources were located as a result of the survey and no further archaeological work is recommended for this project. However, it is noted that two houses on the northeast corner of the project area were bulldozed and burned approximately one month prior to the archaeological survey. The structures are believed to have been constructed prior to 1940. There are no artifactual remains in the area probably due to the bulldozing prior to burning. What remains today is foliage, trees and bushes that would be associated with people and homes.

The following procedures must be followed:

1) **If unrecorded cultural resources are located during utilization of this property, work must halt in the vicinity and the finds must be assessed by a qualified archaeologist.**

2) **If human remains are discovered at any time on this property, work must halt in the area of the find and the Kern County Coroner must be notified immediately (Health and Safety Code Section 7050.5). In addition, a qualified archaeologist should be notified.**

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CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

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(RS# 05-434)

DATE: August 15, 2005

PRIORITY

RE: TG&S Job # 08-05-24

County: Kern

Map(s): Delano East, Delano West, Pond, and McFarland 7.5's

CULTURAL RESOURCES RECORDS SEARCH

The Southern San Joaquin Valley Information Center is under contract to the State Office of Historic Preservation and is responsible for the local management of the California Historical Resources Inventories. The following are the results of a search of the cultural resources files at the Southern San Joaquin Valley Archaeological Information Center. These files include known and recorded archaeological and historic site information, inventory and excavation reports filed with this office, and properties listed on the National Register of Historic Places, the Historic Property Data File, (5/2/05) The California Register, the California Historical Landmarks, the California Inventory of Historic Resources, and the California Points of Historical Interest.

PRIOR CULTURAL RESOURCE INVENTORIES WITHIN THE PROJECT LOCATION AND A ONE-MILE RADIUS

According to the information in our files, there have been no previous surveys conducted within the project area. There have been (2) two surveys conducted immediately adjacent, KE-1818 & 2588, (4) four surveys within a $\frac{1}{2}$ mile and (3) three surveys within a one-mile radius. See the enclosed map for survey locations and their associated report numbers.

KNOWN CULTURAL RESOURCES WITHIN THE PROJECT LOCATION AND A ONE-MILE RADIUS

There is one recorded cultural resource within the project area, P-15-002989, and no recorded cultural resources within a one-mile radius of the project area.

PRIORITY

KE: 03105

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AREAS OF FIELDWORK: Active in archaeological investigations since 1978. Experience in the central and southern San Joaquin Valley, the southern Sierra Nevada/Tehachapi Mountains, the Temblor and Coast Ranges, and the Mojave Desert.

SUMMARY OF EXPERIENCE: Twenty-seven years of field experience in central and southern California, participation in over 500 surveys and excavations, 14 years as Assistant Coordinator and three years as Coordinator of the Southern San Joaquin Valley Archaeological Information Center. Two years as Assistant Director of the Cultural Resource Facility, California State University, Bakersfield. Ten years as a private consultant.

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A complete vita is available upon request.

APPENDIX 3.6

GEOLOGY AND SOIL STUDIES

BSK

BSK Associates
Engineers & Laboratories

PRELIMINARY GEOLOGIC HAZARDS EVALUATION AND GEOTECHNICAL ENGINEERING INVESTIGATION REPORT PROPOSED GRAPEVINE PROJECT DELANO, CALIFORNIA

BSK E13-009-01S

PREPARED FOR:

CITY OF DELANO
1005 Eleventh Avenue
Delano, CA 93216

APRIL 15, 2013

Engineers, Geologists, Inspectors and Scientists

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April 15, 2013 **BSK Job No: E13-009-01S**

Ms. Richelle C. Carino, Community Development Director
City of Delano
1005 Eleventh Avenue
Delano, CA 93216

SUBJECT: Preliminary Geologic Hazards Evaluation and Geotechnical Engineering Investigation Report
Proposed Grapevine Project
Delano, California

Dear Ms. Carino,

BSK Associates (BSK) has completed the geotechnical engineering investigation for the Proposed Grapevine Project located north of Woollomes Avenue and west of Highway 99 in the City of Delano, California. The geotechnical engineering investigation, which included a field exploration, laboratory testing program, engineering analysis, and preparation of this report, was conducted in accordance with our BSK Proposal Addendum, dated March 5, 2013. The enclosed report provides geotechnical recommendations for use in preparation of plans and specifications for the subject project.

We appreciate the opportunity to assist you during the preliminary environmental phase of your project and look forward to continuing our relationship on this project through continued development. If you have any questions, please contact us.

Respectfully submitted,
BSK ASSOCIATES

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BSK

PRELIMINAY GEOLOGIC HAZARDS EVALUATION AND GEOTECHNICAL ENGINEERING INVESTIGATION REPORT
PROPOSED GRAPEVINE PROJECT
DELANO, CALIFORNIA

1.0 INTRODUCTION

This report presents the results of a preliminary geologic hazards evaluation and geotechnical engineering investigation conducted by BSK Associates (BSK) for the proposed Grapevine Project to be located north of Woollomes Avenue and west of Highway 99 in the City of Delano (Site). The Site is located in the City of Delano, Kern County, California as shown on the Site Vicinity Map, Figure 1.

BSK observed and documented the excavation of six (6) borings on March 19, 2013 to a maximum explored depth of 51.5 feet beneath the existing ground surface. Figure 2 presents a Site Plan showing the locations of the soil borings.

This report provides a preliminary evaluation of the geologic and geotechnical conditions at the site to support the preparation of a California Environmental Quality Act (CEQA) document. This report provides preliminary recommendations for earthwork and foundation design with respect to the planned facility. In the event that changes occur in the design of the project, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing. Examples of such changes would include location, size of structures, foundation loads, etc.

1.1 PLANNED CONSTRUCTION

BSK understands that the site is located at the existing vacant parcel. As shown on Figure 2, the proposed project consists of a two anchor buildings located at the northern portion of the site with building footprints of over 40,000 square feet, six major buildings with building footprints of up to 30,000 square feet, seven shops buildings with building footprints of up to 17,000 square feet, and nine pads buildings with footprints up to 6,500 square feet. BSK anticipates that buildings will conisit of single-story, steel frame structure with concrete slab-on-grade. Asphalt concrete parking and drive areas and Belmont Street at the western site boundary will also be constructed. The structural loading is expected to be moderate to relatively light.

The site grades will generally conform to the existing topography after completion of the construction. We anticipate that cut and fill operations will be required during site grading to provide a level working surface for the construction of foundations.

In the event that significant changes occur in the design of the proposed improvements, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing.

1.2 PURPOSE AND SCOPE OF SERVICES

The objective of the preliminary geologic hazards evaluation and geotechnical engineering investigation was to evaluate the geologic hazards, characterize the subsurface conditions in the areas of the proposed structure areas, and provide geotechnical engineering recommendations for the preparation of plans and specifications. BSK's scope of services for this assessment included the following: a review of published geologic literature; an evaluation of the data collected; a field exploration program; laboratory testing; determination of site class and seismic design parameters; liquefaction and seismic settlement analyses; an engineering analyses; and preparation of this report.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 FIELD EXPLORATION

The field exploration for this investigation was conducted under the oversight of a BSK technical representative. Six (6) borings were drilled at the site on March 19, 2013. The borings were drilled to depths ranging from 21.5 to 51.5 feet beneath the existing ground surface (bgs). The locations of the borings are indicated on the Site Plan, Figure 2. Details of the field exploration and the boring logs are provided in Appendix A.

2.2 LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate moisture content, dry density, shear strength, consolidation properties, expansion index, plasticity index, #200 wash, and corrosion characteristics. A description of the laboratory test methods and results are presented in Appendix B.

3.0 SITE CONDITIONS

The following sections address the site description, surface and subsurface conditions, and groundwater conditions at the Site. This information is based on BSK's field exploration and published maps and reports.

3.1 SITE DESCRIPTION AND SURFACE CONDITIONS

The site is located at the northwest corner of Woollomes Avenue and South Dover Street, in Delano, Kern County, California.

The site coordinates are:

Latitude 35.748ºN

Longitude 119.252ºW

3.2 SITE SURFACE SOILS

Figure 4 presents a soil map showing the site area mapped soil types based on the U.S.D.A. SSURGO Database. According to the Soil Survey Geographic (SSURGO) database for Kern County, California, obtained from the U.S.D.A., Natural Resources Conservation Service, the majority of the Site is located on soils identified as Kimberlina fine sandy loam. 0 to 2 percent slopes. Kimberlina soils form from alluvium with parent materials of igneous and sedimentary

rock. These soils are well drained, with high available water capacity and a moderately high hydraulic conductivity. Kimberlina soils have an engineering classification of SM (Silty Sand) and would be considered non plastic to low plasticity with low expansive potential.

The northeast and southeast corners of the Site are located on soils identified as Wasco sand loam. Wasco soils form from alluvium with parent materials of granitic rock. Wasco soils are well drained, with moderate available water capacity and a high hydraulic conductivity. These soils have an engineering classification of SM (Silty Sand) and would be considered non-plastic to low plasticity with low expansive potential.

Observations made during the site investigation indicate that the surface soils generally consists of loose, sandy silt, clayey sand to sandy silty clay.

3.3 SITE TOPOGRAPHY

As shown on Figure 3, the site and surrounding area topography is relatively flat with a ground surface elevation ranging from 295 to 305 feet, USGS datum.

3.4 SUBSURFACE CONDITIONS

The shallow subsurface soils generally consisted of silty sand to sandy silt and sandy clay. Poorly graded sand was encountered in Borings B-1 and B-3 at a depth of 10 feet and 5 feet respectively. Alternativing layers of silty sand to sandy silt, silty clay and sand were encountered to the total depth of the boring 51.5 feet. Based on field and laboratory testing, upper soils appear to be medium dense to very stiff with dry densities ranging from 87 pounds per cubic foot (pcf) to 118 pcf and moist with moisture contents ranging from 1 percent to 26 percent. The maximum explored depth for the site investigation was 51.5 feet bgs.

3.5 GROUNDWATER CONDITIONS

The Site is within the San Joaquin Basin Hydrologic Study Area. This includes approximately the southern two-thirds of the Great Valley. Within the Study Area, 39 groundwater basins and areas of potential storage have been identified. The boundaries of these areas are based largely on hydrologic, as well as political considerations.

Groundwater was not encountered in the borings excavated to a maximum depth of 51.5 feet at the Site on March 19, 2013. Department of Water Resources well data from wells in the vicinity of the Site, indicate that the depth to groundwater in the area is greater than 50 feet bgs.

The possibility of the groundwater table rising to shallower depths and/or the presence of perched groundwater may occur due to irrigation, seasonal effects, or other factors were not evident at the time of the investigation.

3.6 GEOLOGIC SETTING

The site is located in the Great Valley geomorphic province. The Site is located in the structural region identified by Bartow, 1991 as the San Joaquin Valley portion of the southern Sierran block. This area forms a broad syncline with deposits of marine and overlying continental sediments, Jurassic to Holocene in age. The thickness of the sediments increases to the west and reach a thickness of as much as 20,000 feet on the west side of the San Joaquin Valley syncline.

As shown on Figure 5, the Site is situated on recent alluvial fan deposits which are the result of the development of alluvial fans from the Sierra Nevada Mountains to the east.

4.0 GEOLOGIC/SEISMIC HAZARDS

The types of geologic and seismic hazards assessed include surface ground fault rupture, liquefaction, seismically-induced settlement, slope failure, flood hazards and inundation hazards.

4.1 FAULT RUPTURE HAZARD ZONES IN CALIFORNIA

The purpose of the Alquist-Priolo Geologic Hazards Zones Act, as summarized in CDMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

The Site is not located in a Fault-Rupture Hazard Zone. As shown on Figure 6, the closest Fault-Rupture Hazard Zone is associated with the Pond Fault located approximately 3.6 miles southwest of the Site.

4.2 STATE OF CALIFORNIA SEISMIC HAZARD ZONES (LIQUEFACTION AND LANDSLIDES)

The Site is not currently located in a Seismic Hazard Zone specified by State of California.

4.3 SLOPE STABILITY AND POTENTIAL FOR SLOPE FAILURE

The site and surrounding areas are essentially flat and the potential hazard due to landslides from adjacent properties is not applicable.

4.4 LAND SUBSIDENCE

Land subsidence in California generally occurs in areas of fluid removal (petroleum and groundwater) and in arid areas due to hydrocompaction of loose near-surface soils.

The Site is not located in an area susceptible to significant subsidence due to petroleum or groundwater withdrawal. The Site is not located in an area which soils are known to be impacted by hydrocompaction (Poland, 1975, page H2).

4.5 SOIL CORROSIVITY

Surface soil samples obtained from the Site were tested to provide a preliminary screening of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts. The test results are presented in Appendix B.

Based on our experience in this area, high sulfate may exist in soils located across the site. Additional soil sampling and anlysis will be required during the design phase to confirm the sufate content of the soils a the Site. Type V cement may be required based on additional testing. In this area, generally, the soil has a low resistivity which is considered corrosive to buried metal

conduit. Therefore, buried metal conduits, ferrous metal pipes, and exposed steel should have a protective coating in accordance with the manufacturer's specification.

4.6 EXPANSIVE SOILS

Near-surface soils encountered in our exploratory borings consist primarily of silty sand to sandy silt and sandy clay with a moderately high potential for expansion. These soils have the potential to cause displacement and possible damage to surface improvements such as concrete slab-on-grade floors and exterior walkways. The potential effects of the shrinking and swelling of expansive soils and the associated impacts can be mitigated through prudent grading and design of the structures. Recommendations to help mitigate the impact of near-surface expansive soils are addressed in this report and should be implemented in the design and construction of the project.

4.7 FLOOD ZONES

An evaluation of flooding at the site includes review of potential hazards from flooding during periods of heavy precipitation and flooding. Digital Flood Insurance Rates Maps (DFIRMs) published by the Federal Emergency Management Agency (FEMA) were obtained and compiled. As shown on Figure 7, according to DFRIM data, the southern portion of the Site is located in the one percent annual chance flood zone. An adjacent site located to the southeast, also shown on Figure 7 has recently had the FEMA flood zone modified by a Conditional Letter of Map Revision (CLOMR) dated November 29, 2011.

5.0 SEISMIC HAZARD ASSESSMENT

5.1 SEISMIC SOURCES

Figure 8 presents a regional fault map showing the major fault which may impact the Site. The probabilistic value of ground motion at a site can be caused by earthquakes on any of the sources surrounding the site. Deaggregation of the seismic hazard was performed by using the USGS interactive deaggregation website. The deaggregation at the MCE hazard level results in distance, magnitude and epsilon (round-motion uncertainty) for each source which contributes to the hazard. Each source has a corresponding epsilon which is the probabilistic value relative to the mean value of ground motion for that source.

Table 1, below, lists the result of deaggregation at the MCE hazard level from the USGS website. The source which contributes the highest acceleration to the PGA is a rupture of multiple segments of the Southern San Andreas Fault (SSA). Based on this, for liquefaction and seismic settlement, a magnitude (Mw) of 7.9 would be appropriate for input parameters which are consistent with the design earthquake ground motion.

TABLE 1
Seismic Hazard Deaggregation
Maximum Considered Earthquake

Seismic Source	Percent Contribution	Distance (km)	Magnitude (Mw)	Epsilon (Mean Values)
PGA Deaggregation (USGS 2008)				
California A-faults	13.1	74.0	7.83	2.0
CA Compr. crustal gridded	85.9	12.5	5.92	0.7
SSA;PK+CH+CC+BB+NM+SM aPriori	2.8	73.6	7.91	1.9

5.2 HISTORICAL SEISMICITY

Table 2 provide the location, earthquake magnitude, Site to earthquake distances, dates and the resulting Site peak horizontal acceleration for the period 1800 to 1999. The table shows that the Site has experienced mean plus one sigma peak horizontal acceleration up to 0.23g from the from the 1857 Fort Tejon earthquake on the San Andreas fault. In general the site has subjected to relatively low intensity ground motion, primarily from large earthquakes on distance faults and low magnitude earthquakes closer to the site. Figure 9 presents historical earthquake magnitude and locations relative to the Site.

TABLE 2
Historic Earthquakes Within 100 Miles of the Site
Ground Motion Greater Than 0.05g

File Code	Latitude (North)	Longitute (West)	Date	Depth (km)	Earthquake Magnitude	Site Acceleration (g)	Distance mi (km)
DMG	35.3	119.8	01/09/1857	0	7.9	0.23	43.6 (70.2)
DMG	35	119.017	7/21/1952	0	7.7	0.18	53.3 (85.8)
DMG	36.7	118.1	03/26/1872	0	7.8	0.12	91.9 (147.8)
DMG	35.383	118.85	7/29/1952	0	6.1	0.11	33.8 (54.4)
T-A	34.83	118.75	11/27/1852	0	7	0.10	69.4 (111.7)
DMG	35.333	118.917	8/22/1952	0	5.8	0.09	34.3 (55.2)
DMG	35.75	120.25	3/10/1922	0	6.5	0.09	55.9 (90.0)
DMG	35	119	7/21/1952	0	6.4	0.09	53.6 (86.2)
BRK	36.22	120.29	5/2/1983	0	6.7	0.09	66.5 (107.0)
DMG	35.367	118.583	7/23/1952	0	6.1	0.09	45.9 (73.8)
DMG	35.75	119.617	4/15/1950	0	4.6	0.07	20.4 (32.9)
DMG	35.333	118.6	7/31/1952	0	5.8	0.07	46.5 (74.8)
DMG	35.6	118.8	6/30/1926	0	5	0.07	27.3 (44.0)
DMG	35.217	118.817	7/23/1952	0	5.7	0.07	44.1 (70.9)
DMG	35.725	118.055	3/15/1946	22	6.3	0.07	67.1 (108.0)
DMG	35	119.017	1/12/1954	0	5.9	0.07	53.3 (85.8)
T-A	36.17	119.32	07/25/1868	0	5	0.07	29.4 (47.3)
PAS	36.151	120.049	8/4/1985	6	5.8	0.07	52.5 (84.5)
DMG	35.8	120.33	6/8/1934	0	6	0.07	60.5 (97.3)
DMG	34.9	118.9	10/23/1916	0	6	0.07	61.8 (99.5)
DMG	35.4	118.817	7/29/1952	0	5.1	0.06	34.3 (55.1)
DMG	35.315	118.516	7/25/1952	11.2	5.7	0.06	51.0 (82.1)
DMG	35.317	118.494	7/25/1952	5.5	5.7	0.06	52.0 (83.6)
DMG	36.08	118.82	5/29/1915	0	5	0.06	33.3 (53.6)
DMG	34.8	119.1	09/05/1883	0	6	0.06	66.0 (106.2)
DMG	35.5	118.7	1/6/1905	0	5	0.06	35.4 (57.0)
DMG	35	119.033	7/21/1952	0	5.6	0.06	53.1 (85.4)
DMG	36.9	118.2	03/26/1872	0	6.5	0.06	98.7 (158.9)
DMG	35.133	118.767	7/21/1952	0	5.5	0.06	50.5 (81.2)
BRK	36.22	120.4	7/22/1983	0	6	0.06	71.9 (115.8)
GSP	35.149	119.104	5/28/1993	21	5.2	0.06	42.2 (67.9)
PAS	35.452	118.899	2/8/1985	11.1	4.6	0.06	28.5 (45.8)

5.3 EARTHQUAKE GROUND MOTION

5.3.1 SITE CLASS

Based on the "N" values from our soil boring completed in March 2013, as per Table 1613.5.2 of 2010 CBC, the Site is Class D ($15 \leq N \leq 50$).

5.3.2 2010 CALIFORNIA BUILDING CODE

The earthquake hazard level of the maximum considered earthquake (MCE) is define in ASCE 7-05 as the ground motion resulting from a seismic source(s) having a probability of exceedance of 2% in 50 years. The United States Geologic Survey (USGS) has prepared maps presenting the MCE spectral acceleration (5% damping) for periods of 0.2 seconds (S_S) and 1.0 seconds (S_1). The values of S_S and S_1 can be obtained from the USGS Ground Motion Parameter Calculator available at: http://earthquake.usgs.gov/research/hazmaps/design/index.php.

The USGS Ground Motion Parameter Calculator and Chapter 16 of 2010 CBC produced the following values based on Site Class D conditions:

TABLE 3

Seismic Design Parameters

Seismic Design Parameter	Value		Reference
MCE Mapped Spectral Acceleration (g)	$S_S = 0.837$	$S_1 = 0.312$	USGS Mapped Value
Amplification Factors (Site Class D)	$F_a = 1.165$	$F_v = 1.775$	Table 1613.5.3
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 0.975$	$S_{M1} = 0.554$	Equations 16-37, 38
Design Spectral Acceleration (g)	$S_{DS} = 0.650$	$S_{D1} = 0.370$	Equations 16-39, 40
Design Peak Ground Acceleration ($S_{DS}/2.5$) (g)	PGA = 0.26		

As shown above, the short period design spectral response acceleration coefficient, SDS, is greater than 0.5, therefore the site lies in Seismic Design Category D as specified in Section 1613.5.6 of the 2010 CBC. The long period design spectral response acceleration coefficient, SD1, is greater than 0.2, therefore the site lies in Seismic Design Category D as specified in Section 1613.5.6 of the 2010 CBC. In accordance with the 2010 CBC, each structure shall be assigned to the more severe seismic design category in accordance with Table 1613.5.6(1) or 1613.5.6(2), irrespective of the fundamental period of vibration of the structure.

5.4 LIQUEFACTION

Liquefaction describes a condition in which a saturated, cohesionless soil loses shear strength during earthquake shocks. Ground motion from an earthquake may induce cyclic reversals of shearing strains of large amplitude. Lateral and vertical movements of the soil mass, combined with loss of bearing strength, usually result from this phenomenon. Historically, liquefaction of soils has caused severe damage to structures, berms, levees and roads. Seed and Idriss (1971) demonstrated that liquefaction potential depends on soil type, void ratio, depth to groundwater, duration of shaking and confining pressures over the potentially liquefiable soil mass. Fine, well sorted, loose sand, shallow groundwater, severe seismic ground motion and particularly long durations of ground shaking are conditions conducive for liquefaction.

The depth to groundwater is currently greater than 50 feet bgs, therefore, the potential for liquefaction is low.

5.5 SEISMICALLY-INDUCED SETTLEMENT

Settlement of the ground surface with consequential differential movement of structures is a major cause of seismic damage for buildings founded on alluvial deposits. Vibration settlement of relatively dry and loose granular deposits beneath structures can be readily induced by the horizontal components of ground shaking associated with even moderate intensity earthquakes. Silver and Seed (1971) have demonstrated that settlement of dry sands due to cyclic loading is a function of 1) the relative density of the soil; 2) the magnitude of the cyclic shear stress; and 3) the number of strain cycles. As indicated above, seismically-induced ground settlement can also occur due to the liquefaction of relatively loose, saturated granular deposits.

A seismic settlement analysis of the unsaturated zones was performed using data from the soil borings B-2 and B-4. Figure 10 and Figure 11 present the plots of the liquefaction/settlement analysis for data from borings B-2 and B-4, respectively. The Liquefy Pro summary sheets are also attached. The settlement due to dry seismic settlement is estimated to be 0.2 inches to 0.3 inches. The differential settlement is estimated to be 0.1 inches to 0.15 inches.

6.0 MINERAL RESOURCES

As shown on Figure 12, according to 1) Mineral land classification resources, Kern County General Plan GIS Data and 2) California Geologic Survey Topographically Occurring Mine Symbols, it does not appear that the site is located on or near a known mineral resource that would be of value to the region and the residents of the state.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the soil conditions would not preclude the construction of the proposed improvements. The near-surface soils across the project site consist primarily of silty sand to sandy silt and sandy clay with a moderately high potential for expansion. Removal and replacement of expansive onsite expansive soils will be required in order to mitigate the potential for damage due to expansive soils. Alternatively, chemical treatment of soils with either lime or cement may be considered, however this alterntive will require additional testing.

The proposed improvements may be supported on shallow foundations if the recommendations presented herein are incorporated into the design and construction of the project.

7.1 SITE PREPARATION AND EARTHWORK CONSTRUCTION

The following procedures must be implemented during Site preparation for the proposed Site improvements. References to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 (latest test revision) laboratory test procedures.

1. The areas of proposed improvements must be cleared of surface vegetation and debris. Materials resulting from the clearing and stripping operations must be removed and properly disposed of off-site. Following stripping operations, BSK recommends overexcavation and replacement with non-expansive soils (EI less than 20) within the upper 3 feet of the building pad or 1 foot below bottom of footing which is greater. The overexcavation must extend 5 feet laterally. The existing on site soils are suitable for reuse as fill below a depth of 3 feet below the bottom of the building pad. Alternatively, chemical treatment of soils with either lime or cement may be considered however this alternative will require additional testing.
2. In addition, we recommend overexcavation and recompaction of the upper 12 inches in the parking and drive areas prior to fill placement. The bottom eight inches of soil in the excavations should be scarified, worked until free from large clods, moisture conditioned as necessary, and recompacted to a minimum 90 percent of maximum dry density prior to fill placement.
3. Following the required stripping and overexcavation, the exposed ground surface must be inspected by the Geotechnical Engineer to evaluate if loose or soft zones are present that will require over excavation.
4. Imported soil or native excavated soils, free of organic materials or deleterious substances, may be placed as compacted engineered fill. The material must be free of oversized fragments greater than 3-inches in greatest dimension. Engineered fill underneath and extending 10 feet beyond the building foundation and must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2 to 4 percent above optimum moisture content, and compacted to at least 90 percent relative compaction. Engineered fill placed on fill slopes must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2 percent of optimum moisture content, and compacted to at least 90% of relative compaction.
5. BSK must be called to the site to verify the import material properties through laboratory testing.
6. If possible, earthwork operations should be scheduled during a dry, warm period of the year. Should these operations be performed during or shortly following periods of inclement weather, unstable soil conditions may result in the soils exhibiting a "pumping" condition. This condition is caused by excess moisture in combination with moving construction equipment, resulting in saturation and zero air voids in the soils. If this condition occurs, the adverse soils will need to be over-excavated to the depth at which stable soils are encountered, and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing a method to stabilize the soil subgrade, which should be subject to review and approval by BSK prior to implementation.
7. Import fill materials must be free from organic materials or deleterious substances. The project specifications must require the contractor to contact BSK to review the proposed import fill materials for conformance with these recommendations at least one week prior to importing to the Site, whether from on-site or off-site borrow areas.

8. Imported fill soils must be non-hazardous and derived from a single, consistent soil type source conforming to the following criteria:
   - Plasticity Index: < 12
   - Expansion Index: < 20 (Very Low Expansion Potential)
   - Maximum Particle Size: 3 inches
   - Percent Passing #4 Sieve: 65 - 100
   - Percent Passing #200 Sieve: 20 - 45
   - Low Corrosion Potential: Soluble Sulfates < 1,500 ppm
     - Soluble Chlorides < 150 ppm
     - Minimum Resistivity > 3,000 ohm-cm

7.2 FOUNDATIONS: SPREAD FOOTINGS AND GRADE BEAMS

Continuous and isolated spread footings must have a minimum width of 12 inches and 24 inches, respectively. Continuous and isolated spread footing foundations may be designed using a net allowable bearing pressure of 2,000 pounds per square foot (psf). The net allowable bearing pressure applies to the dead load plus live load (DL + LL) condition; it may be increased by 1/3 for wind or seismic loads. Total foundation settlements are expected to be less than one-half inch and differential settlements between similarly loaded (DL + LL) and sized footings are anticipated to be less than one-qurter inch. Differential settlement of continuous footings, expressed in terms of angular distortion, is estimated to be approximately 1/600. The majority of the settlement is expected to occur within a few months after the design loads are applied.

7.3 LATERAL EARTH PRESSURES AND FRICTIONAL RESISTANCE

Provided the Site is prepared as recommended above, the following earth pressure parameters for footings may be used for design purposes. The parameters shown in the table below are for drained conditions of select engineered fill.

Table 4
Recommended Static Lateral Earth Pressures for Footings

Lateral Pressure Condition	Equivalent Fluid Density (pcf) Drained Condition
Active Pressure	40
At Rest Pressure	60
Passive Pressure	390

The lateral earth pressures listed herein are obtained by the conventional equation for active, at rest, and passive conditions assuming level backfill and a bulk unit weight of 120 pcf for the silty sand.

A coefficient of friction of 0.3 may be used between soil sub-grade and the bottom of footings.The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum

safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

7.4 RETAINING WALLS

Retaining walls should be designed in accordance with Sections 1807.2.1 through 1807.2.3 of the 2010 CBC. The lateral earth pressures for various slope angles given below may be used for preliminary structural design, however, we ask that BSK be called to review preliminary structural details, so that we can revise our recommendations if necessary. BSK must be called to review structural foundation plans and specifications for retaining walls and shallow foundations prior to issuing a final design for construction. The following parameters are for drained conditions with select backfill:

Table 5
Recommended Static Lateral Earth Pressures for Retaining Walls

Lateral Pressure Condition	Equivalent Fluid Density (pcf), Drained Condition				
Backfill Slope Angle (Degrees)	***-26.6***	***-18.4***	***0***	***18.4***	***26.6***
Active Pressure	30	35	40	50	60
At Rest Pressure	35	40	60	75	85
Passive Pressure	200	285	390	390	390

Drainage behind retaining walls may be provided by a prefabricated drainage system such as Mirafi Miradrain 6000, a 21-inch wide zone of Caltrans Class II permeable material, or by a 12-inch wide zone of open-graded ¾-inch, crushed gravel wrapped in a layer of filter fabric. The drainage system should extend from the base of the retaining wall to within 18 inches of the top of the retaining wall. Drainage for both vertical gravel drains and prefabricated drainage panels should consist of 4-inch diameter, perforated drainpipes located along the base of the retaining walls. The drainpipe should be placed with the perforations positioned along the downside of the pipe. The perforated drainpipe should be placed on a 4-inch thick bed of open graded gravel separated from the native soil by a synthetic non-woven geotextile filter fabric such as Mirafi 140N or equivalent. The drainpipe should be sloped to discharge to a suitable outlet. The installation of a wall drain may not preclude the migration of moisture through the retaining walls. Processed on-site soils, which are free of organic material, are suitable for use as general trench backfill above the pipe envelope. Native soil with particles less than three inches in the greatest dimension may be incorporated into the backfill and compacted as specified above, providing they are properly mixed into a matrix of friable soils. The backfill must be placed in thin layers not exceeding 12 inches in loose thickness, be well-blended and consistent texture, moisture conditioned to at least optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557.

We recommend that retaining wall backfill be tested for compliance with the recommended Relative Compaction and moisture conditions. Field density testing should conform to ASTM Test Methods D1556 or D6938. We recommend that field density tests be performed in the

backfill for every vertical lift, at an approximate longitudinal spacing of not greater than 50 feet. Backfill that does not conform to the criteria specified in this section should be removed or reworked, as applicable over the wall length represented by the failing test so as to conform to BSK recommendations.

7.6 EXCAVATION STABILITY

Soils encountered within the depth explored are generally classified as Type C soils in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than five feet deep and exhibit no indication of potential caving, but should be no steeper than 1.5H:1V for excavations that are deeper than five feet, up to a maximum depth of 15 feet. Certified trench shields or boxes may also be used to protect workers during construction in excavations that have vertical sidewalls and are greater than 5 feet deep. Temporary excavations for the project construction should be left open for as short a time as possible and should be protected from water runoff. In addition, equipment and/or soil stockpiles must be maintained at least 10 feet away from the top of the excavations. Because of variability in soils, BSK must be afforded the opportunity to observe and document sloping and shoring conditions at the time of construction. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

7.7 PIPE BEDDING AND ENVELOPE

A minimum of 6 inches of bedding material is recommended for pipe installations. The bedding material and backfill within the pipe envelope (up to 12 inches above the pipe) should consist of sandy material with not more than 10 percent passing the #200 sieve, 100 percent passing the 3/8-inch sieve, and a sand equivalent of at least 30.

In the case of flexible pipe installation, a minimum of eight inches (8”) of bedding material is recommended for pipe installation. Bedding material must consist of medium- or coarse-grained sand with a Sand Equivalent of at least 25. As an alternative to using sand, the pipe bedding and envelope material may consist of Class 2 Aggregate Base as specified in Section 26 of the Caltrans Standard Specifications or sand–cement slurry that contains 1.5 to 2.0 sacks of cement per yard of material and has a 4- to 6-inch slump.

Bedding and pipe envelope must be placed in loose thickness not exceeding 10-inches and compacted to at least 90 percent of the maximum dry density of ASTM D1557. Soil backfill moisture content during compaction must be maintained within two percent (2%) of optimum. Water jetting to attain compaction should not be allowed. Class 2 Aggregate Base, when used for bedding or pipe envelope must be compacted to at least 92 percent of ASTM D1557.

7.8 TRENCH BACKFILL AND COMPACTION

Processed on-site soils, which are free of organic material, are suitable for use as general trench backfill above the pipe envelope. Native soil with particles less than three inches in the greatest dimension may be incorporated into the backfill and compacted as specified above, provided they are properly mixed into a matrix of friable soils. The backfill must be placed in thin layers

not exceeding 12 inches in loose thickness, be well-blended and consistent texture, moisture conditioned to at least optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM D1557. The uppermost 12 inches of trench backfill below pavement sections must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Moisture content within two percent of optimum must be maintained while compacting the upper 12 inch trench backfill zone.

We recommend that trench backfill be tested for compliance with the recommended Relative Compaction and moisture conditions. Field density testing should conform to ASTM Test Methods D1556 or D6938. We recommend that field density tests be performed in the utility trench bedding, envelope and backfill for every vertical lift, at an approximate longitudinal spacing of not greater than 150 feet. Backfill that does not conform to the criteria specified in this section should be removed or reworked, as applicable over the trench length represented by the failing test so as to conform to BSK recommendations.

7.9 CONCRETE SLABS ON GRADE

Non-structural concrete slab-on-grade floors must be a minimum of 4-inches thick and must be supported on a compacted subgrade prepared in accordance with Section 4.3. In order to regulate cracking of the slabs, construction joints and/or control joints must be provided in each direction at a maximum spacing of 10 feet along with steel reinforcement as recommended by the Project Structural Engineer. Control joints must have a minimum depth of one-quarter of the slab thickness. Due to the difficulty of installing and maintaining woven or welded wire mesh (WWM) in the middle of concrete slabs-on-grade during construction, it is recommended that any steel reinforcement used in concrete slabs-on-grade consist of steel rebar. Structural concrete slabs-on-grade may be designed using a modulus of subgrade reaction equal to 180 pci.

Interior concrete slabs must be successively underlain by: 1-½ inches of washed concrete sand; a durable vapor barrier; and a smooth, compacted subgrade surface. The vapor barrier must meet the requirements of ASTM E 1745 Class A and have a water vapor transmission rate (WVTR) of less than or equal to 0.012 Perms as tested by ASTM E 96. Examples of acceptable vapor barrier products include: Stego Wrap (15-mil) Vapor Barrier by STEGO INDUSTRIES LLC; W.R. Meadows Premoulded Membrane with Plasmatic Core; and Zero-Perm by Alumiseal. Because of the importance of the vapor barrier, joints must be carefully spliced and taped. If migration of subgrade moisture through the slab is not a concern, then the vapor barrier and overlying sand may be deleted. The building subgrade must be kept in a moist condition until the vapor barrier or concrete slab is placed. A representative from BSK must be called to the Site to review soil and moisture conditions immediately prior to placing the vapor barrier or concrete slab.

As indicated in the PCA Engineering Bulletin 119, Concrete Floors and Moisture, and applicable ACI Committee reports (see ACI 360R-06, Design of Slabs-on-Ground, dated October 2006 and ACI 302.1R-04, Guide for Concrete Floor and Slab Construction, dated June 2004), the sand layer between the vapor barrier and concrete floor slab may be omitted. This must reduce the amount of moisture that can be transmitted through the slab (especially if the sand layer becomes very moist or wet prior to placing the concrete); however, the risk of slab “curling” is much

greater. The "curling" may result from a sharp contrast in moisture-drying conditions between the exposed slab surface and the surface in contact with the membrane. As recommended in the referenced ACI Committee reports, measures must be taken to reduce the risk of "curling" such as reducing the joint spacing, using a low shrinkage mix design, and reinforcing the concrete slab. In order to regulate cracking of the slab, we recommend that full depth construction joints and control joints be provided in each direction with slab thickness and steel reinforcing recommended by the structural engineer.

Excessive landscape water or leaking utility lines could create elevated moisture conditions under concrete slabs, which could result in adverse moisture or mildew conditions in floor slabs or walls.

Accordingly, care must be taken to avoid excess irrigation around the structures, as well as to periodically monitor for leaking utility lines. Likewise, positive surface drainage must be provided around the perimeter of the structures.

As indicated above, the control of the deleterious effects of moisture vapor transmission on flooring materials can be substantially improved by the use of a low porosity concrete. This can be achieved by specifying a low water: cement ratio (0.45 or less by weight), 4,000 psi compressive strength at 28 days and a minimum of 7 days wet-curing.

7.10 DRAINAGE CONSIDERATIONS

The control surface drainage in the project areas is an important design consideration. BSK recommends that final grading around the structures must provide for positive and enduring drainage away from the structures, and ponding of water must not be allowed around, or near the structure. Ground surface profiles next to the structures must have at least a 2 percent gradient away from the structures. BSK does not make any recommendations for particular materials or methods for the water retention, drainage, or collection. We recommend that a structural engineer select and specify appropriate materials for water-proofing.

8.0 ADDITIONAL GEOTECHNICAL REPORT AND SPECIFICATIONS REVIEW

Once the final site building layout is known, BSK recommends that it be retained to perform a design level Geotechnical Engineering Investigation. We also recommend the BSK review the draft plans and specifications for the project, with regard to foundations and earthwork, prior to their being finalized and issued for construction bidding.

9.0 CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this Geologic Hazards Evaluation and Geotechnical Engineering Investigation. BSK recommends that it be retained for those services. Field review during site preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK's observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess

whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. BSK must also be called to the Site to observe placement of foundation and slab concrete.

If a firm other than BSK is retained for these services during construction, then that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

10.0 LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the borings performed at the locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between or beyond the borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

The findings of this report are valid as of the present. However, changes in the conditions of the Site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Kern County at the time the report was written. No other warranties either expressed or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

11.0 REFERENCES

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United States Geological Survey Topographic 15 minute quadrangles: Digital files from Cal-Atlas http://atlas.ca.gov/

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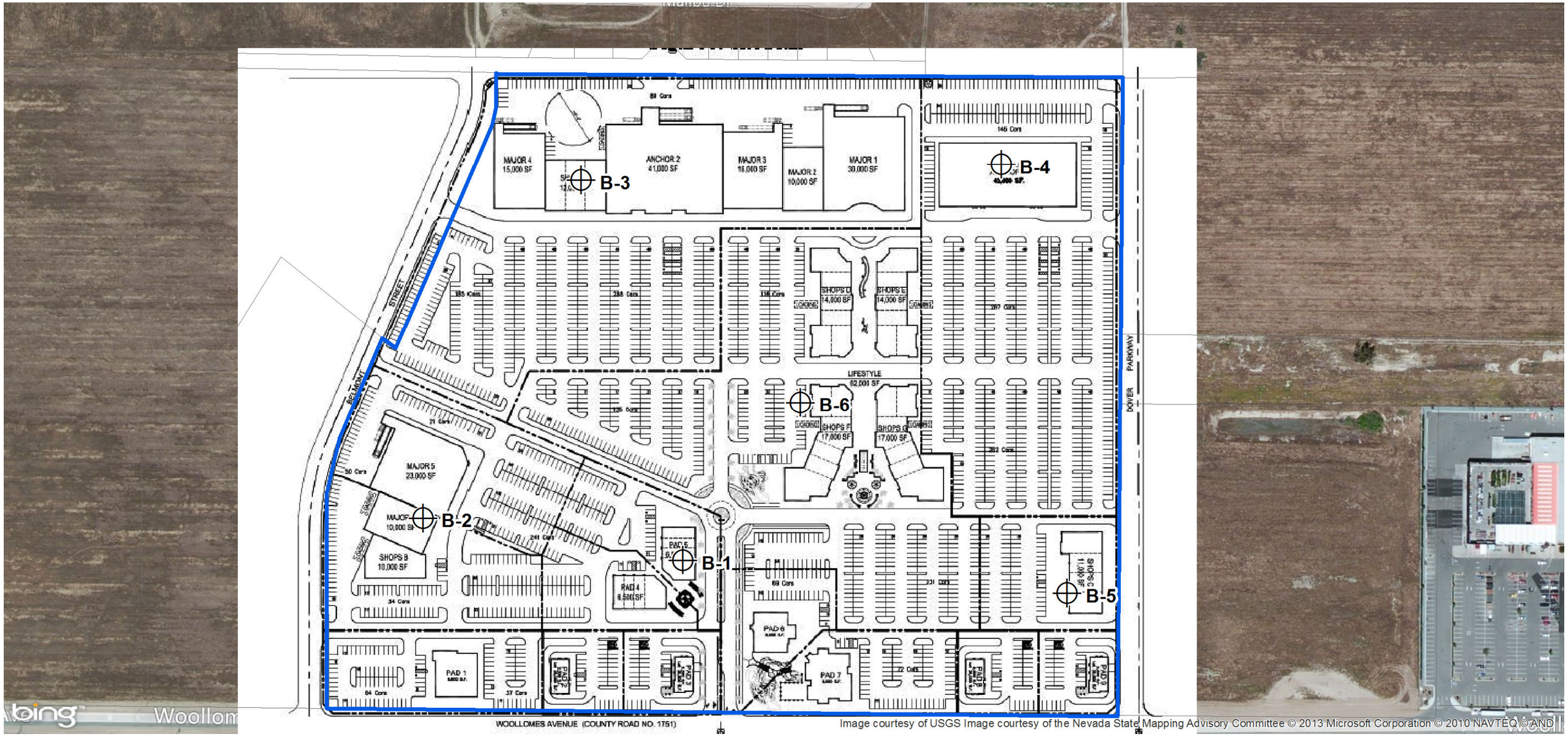
BSK Associates
Engineers & Laboratories

The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

Figure 1
Vicinity Map
BSK Project E1300901S

Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\Figure 1 Vicinity.mxd



Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\Figure 2-Borings.mxd

Site Layout Map Provided by YK America, March 2013

Legend

- Site Area
- Approximate Boring Location

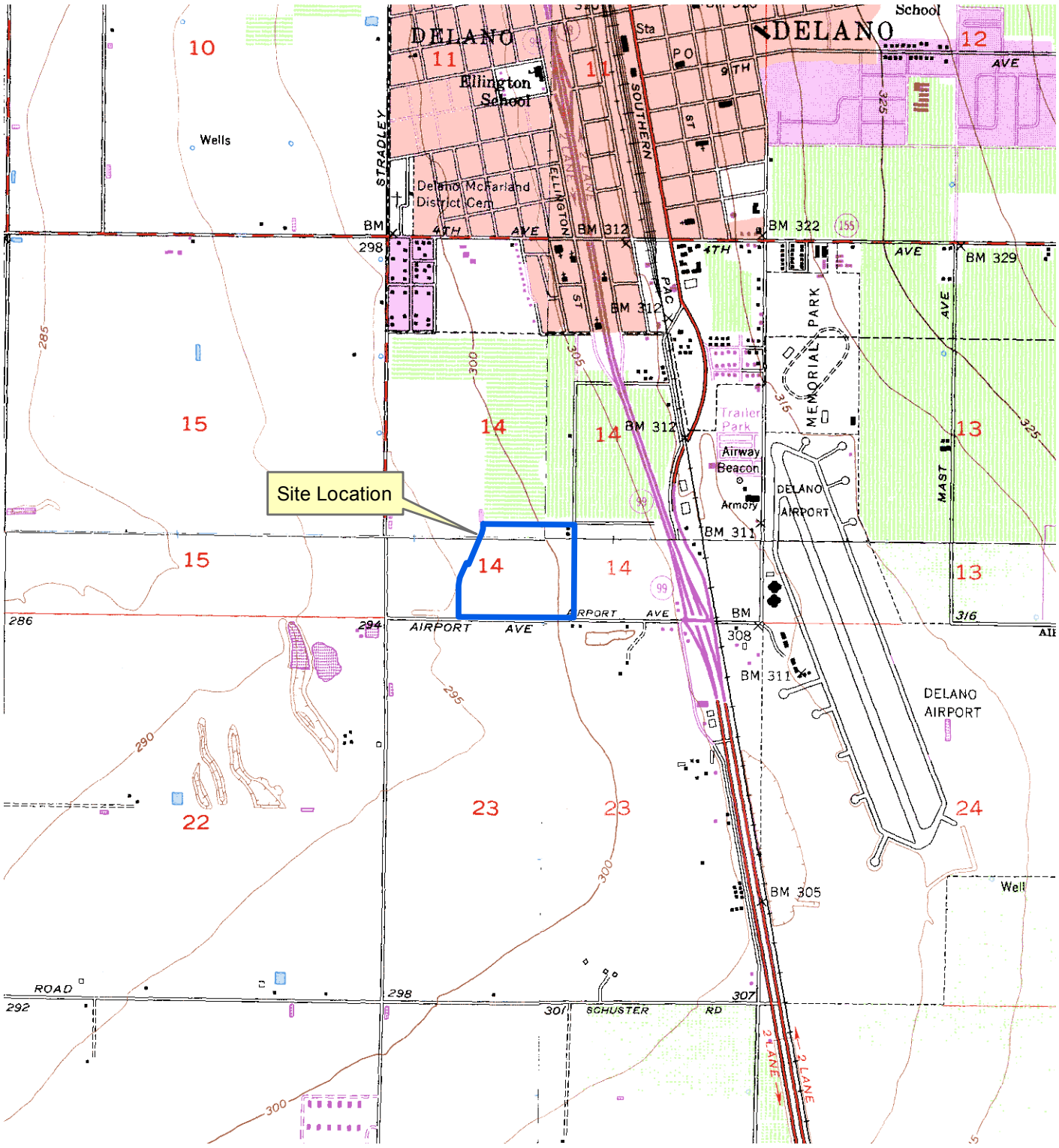
BSK Associates Engineers & Laboratories

N W E S

0 100 200 400 Feet

Map Date: 4/12/2013

The Grapevine Project NW Corner of Woollomes and S. Dover Delano, California	**Figure 2** **Site Map** **BSK Project E1300901S**



Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\Figure 2 topographic.mxd

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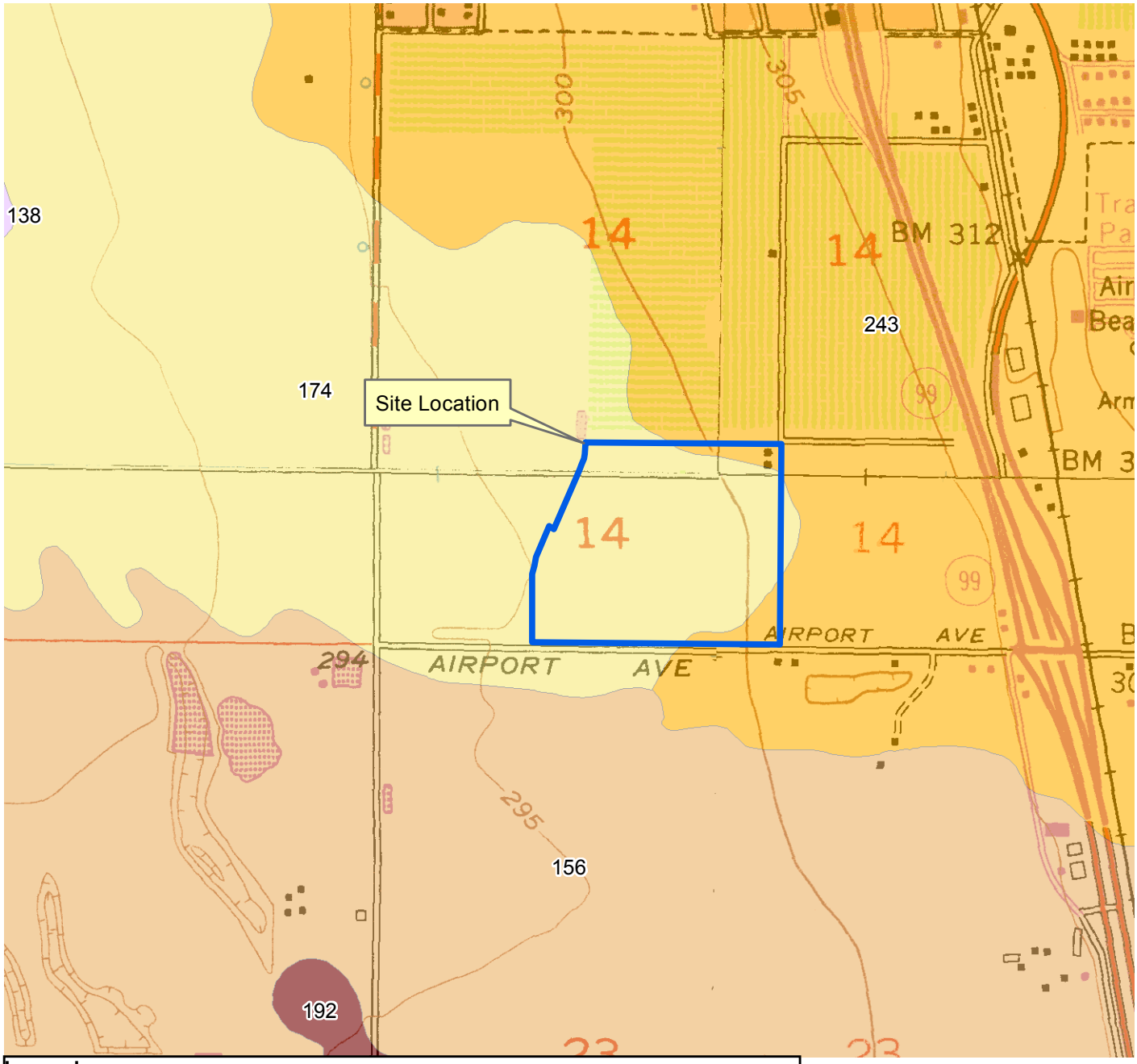
Base Map Source: http://atlas.ca.gov/quads/

Map Date: 4/12/2013

BSK Associates Engineers & Laboratories

Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 3
Topographic Map
BSK Project E1300901S



Legend

Symbol | Map Unit Name	
138 | Delano sandy loam, 0 to 2 percent slopes	174 | Kimberlina fine sandy loam, 0 to 2 percent slopes
156 | Garces silt loam	192 | McFarland loam
	243 | Wasco sandy loam

N
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0 500 1,000 2,000 Feet

Source: USDA, SSURGO Soil Dataset, 1/10/2008, Kern County, California, Northwestern Part, ca666

Map Date: 4/9/2013

BSK Associates Engineers & Laboratories

Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 4
Soil Map
BSK Project E1300901S

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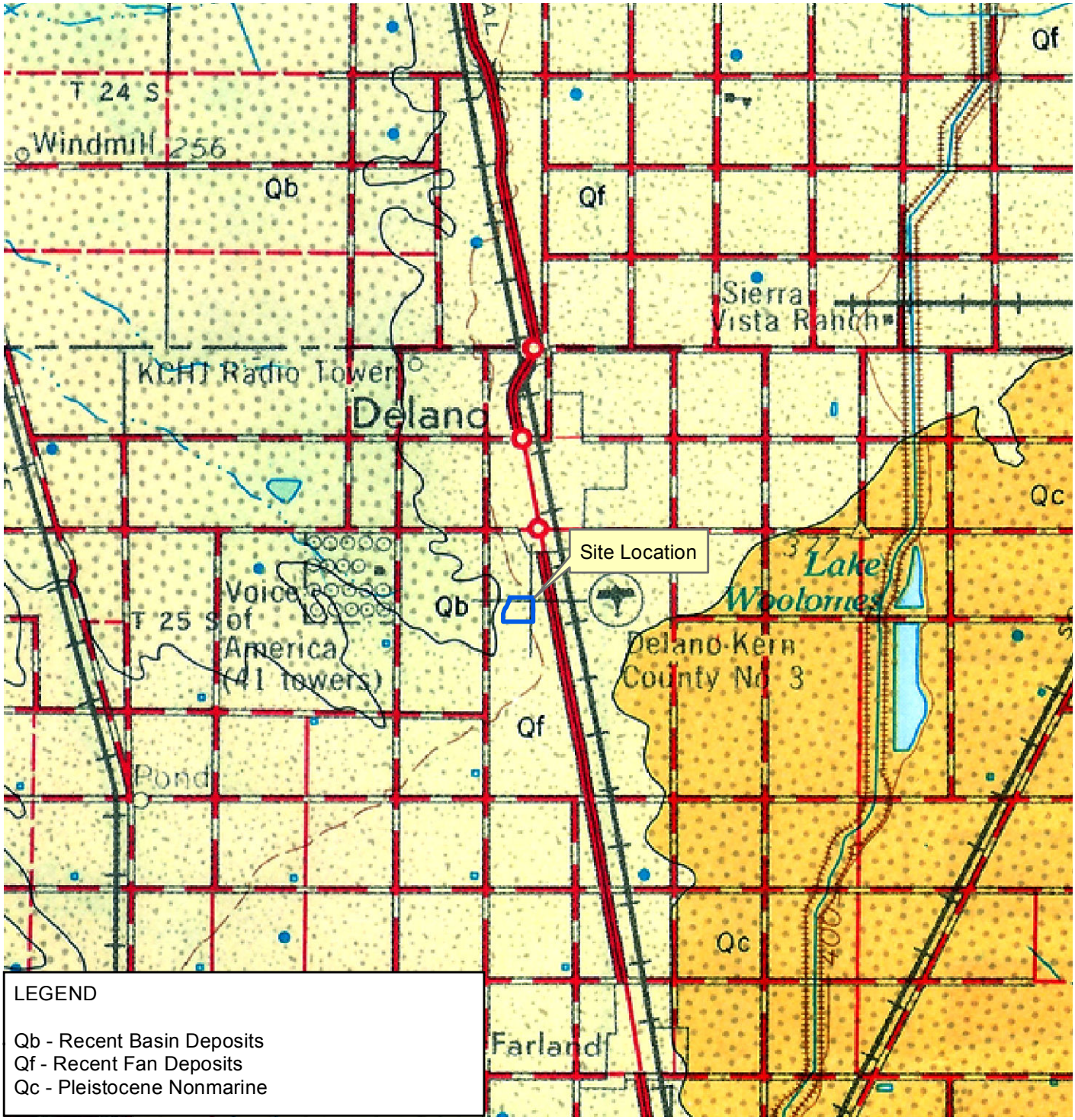

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Source: Source: Geologic Map of California, Bakersfield Sheet, 1965

Map Date: 4/9/2013

BSK Associates Engineers & Laboratories

Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 5
Geologic Map
BSK Project E1300901S

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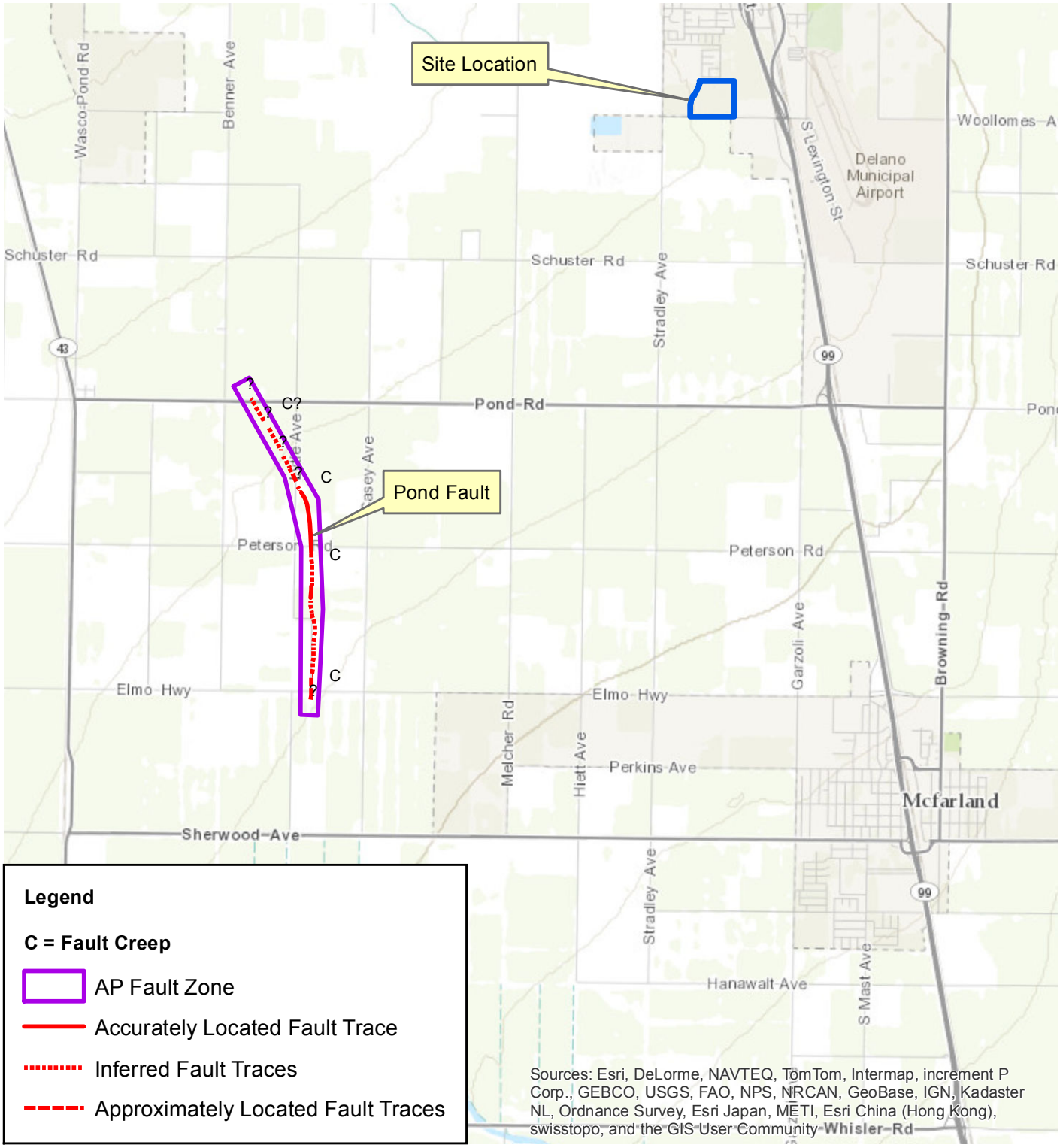

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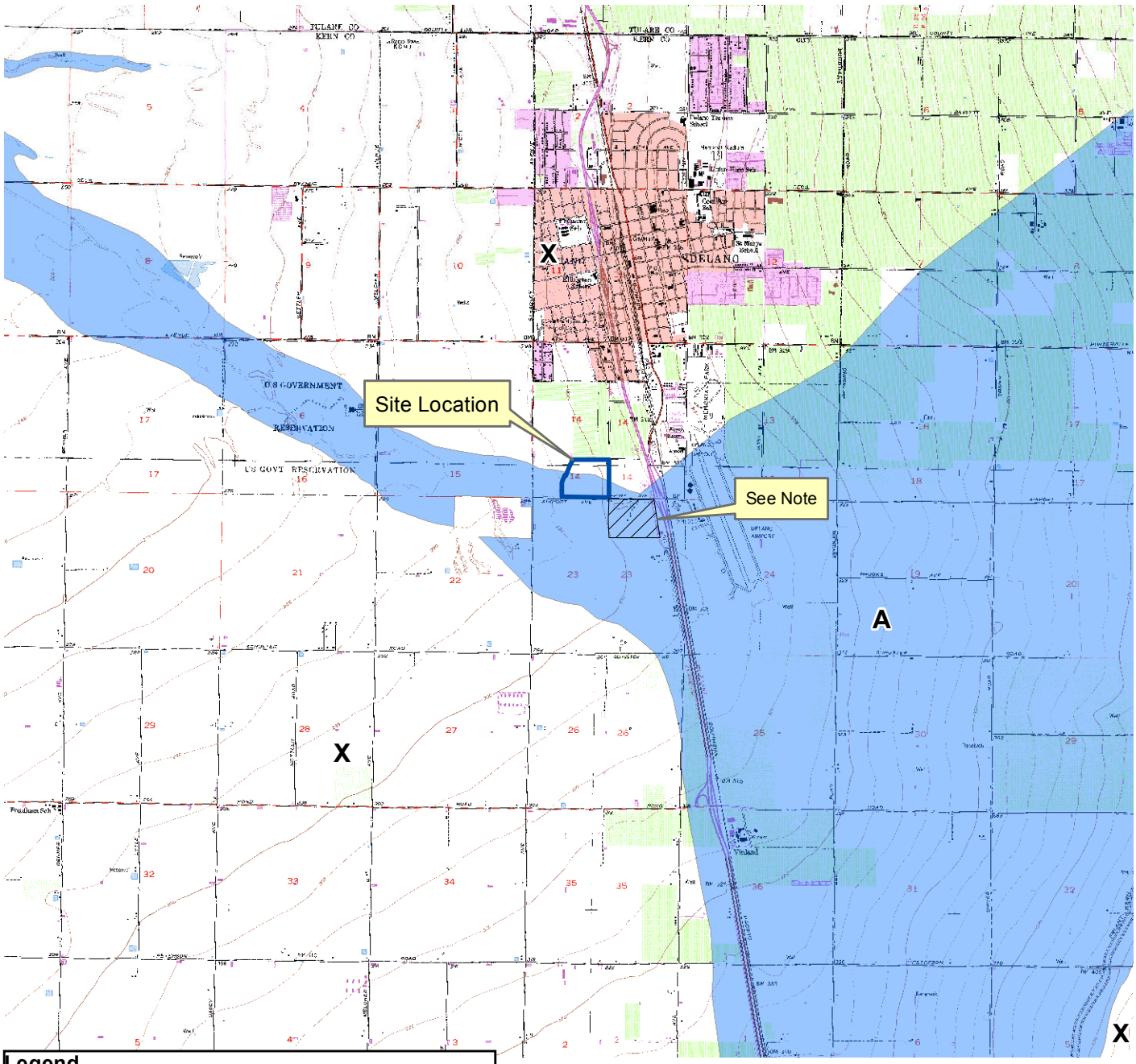
Source: http://www.conservation.ca.gov/cgs/rghm/ap/Pages/index.aspx

Map Date: 4/9/2013

BSK Associates Engineers & Laboratories

Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 6
AP Fault Zone Map
BSK Project E1300901S



Legend

CLOMR Modified Zone

FEMA DFirm Flood Hazard Zones

A - Areas with a 1% annual chance of flooding

X - Area of minimal flood hazard

N
W E
S

0 0.5 1 2 Miles

Note: Flood Zone Modified for this Site, Conditional Letter of Map Revision (CLOMR, November 29, 2011)

Source: FEMA D-Firm Kern County, 2008

Map Date: 4/15/2013

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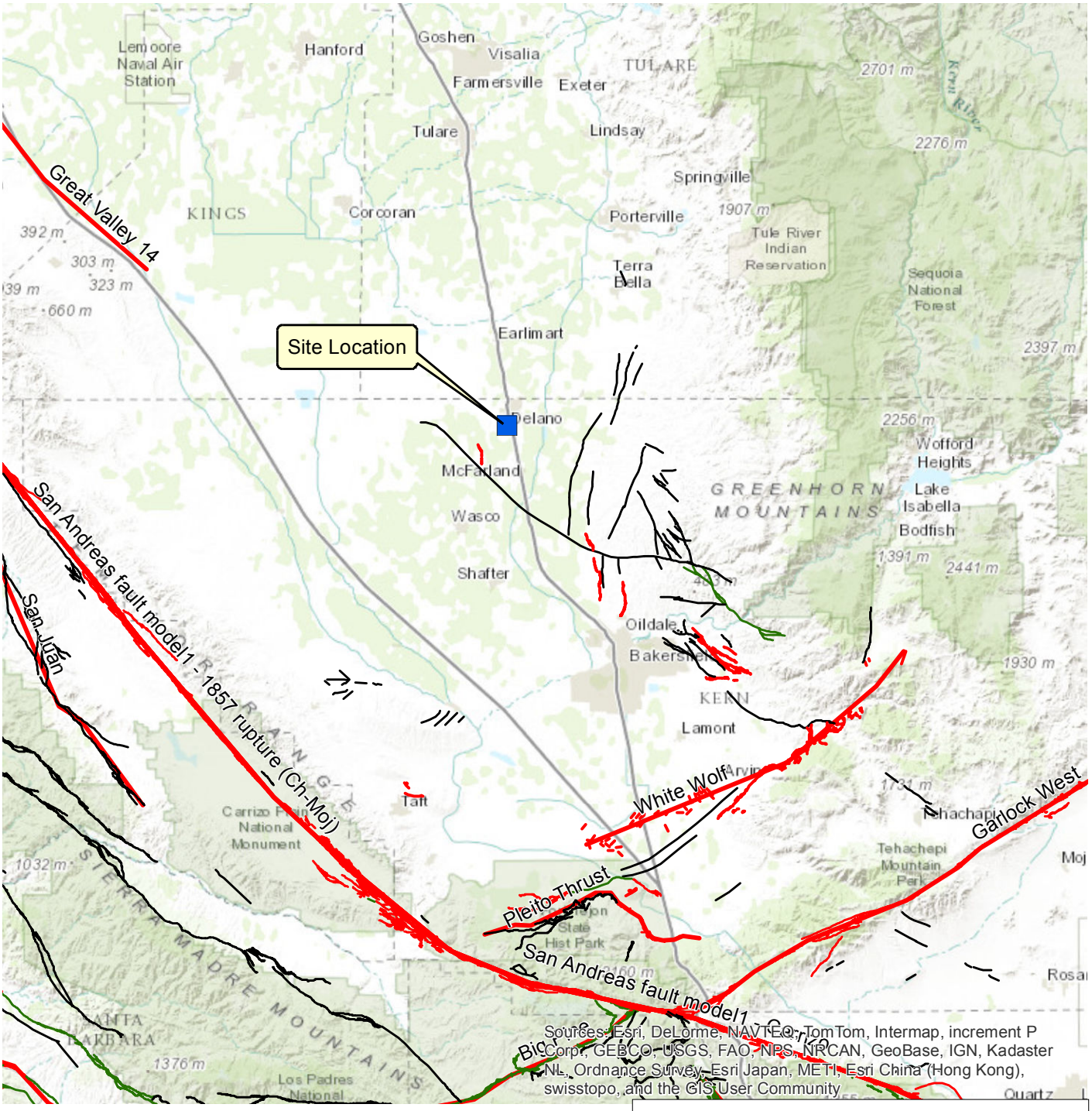
Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 7
FEMA Flood Zones
BSK Project E1300901S

Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\Figure 12 FEMA.mxd



Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\regional-fault-map.mxd

N
W E
S

Map Date: 4/15/2013

0 10 20 40
Miles

Source: USGS 2008 Fault Database

Legend

Fault Activity Age

- Historic
- Holocene
- Late Pleistocene
- Mid Pleistocene
- Early Pleistocene

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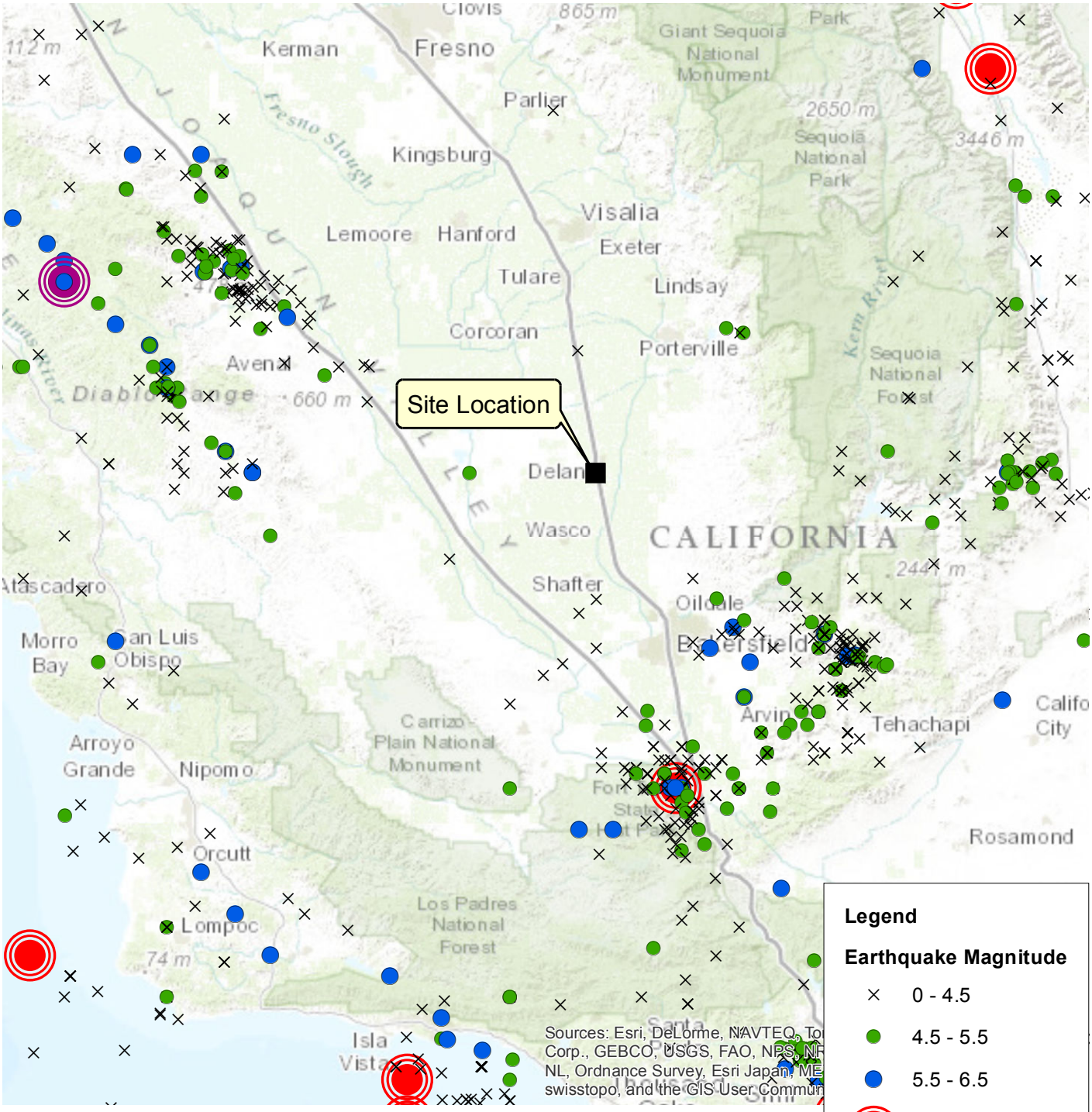
Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 8
Regional Fault Map
BSK Project E1300901S



Map Date: 4/15/2013

Source: California Geologic Survey EQ Catalog, 2000

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Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 9
Earthquake Epicenter Map
BSK Project E1300901S

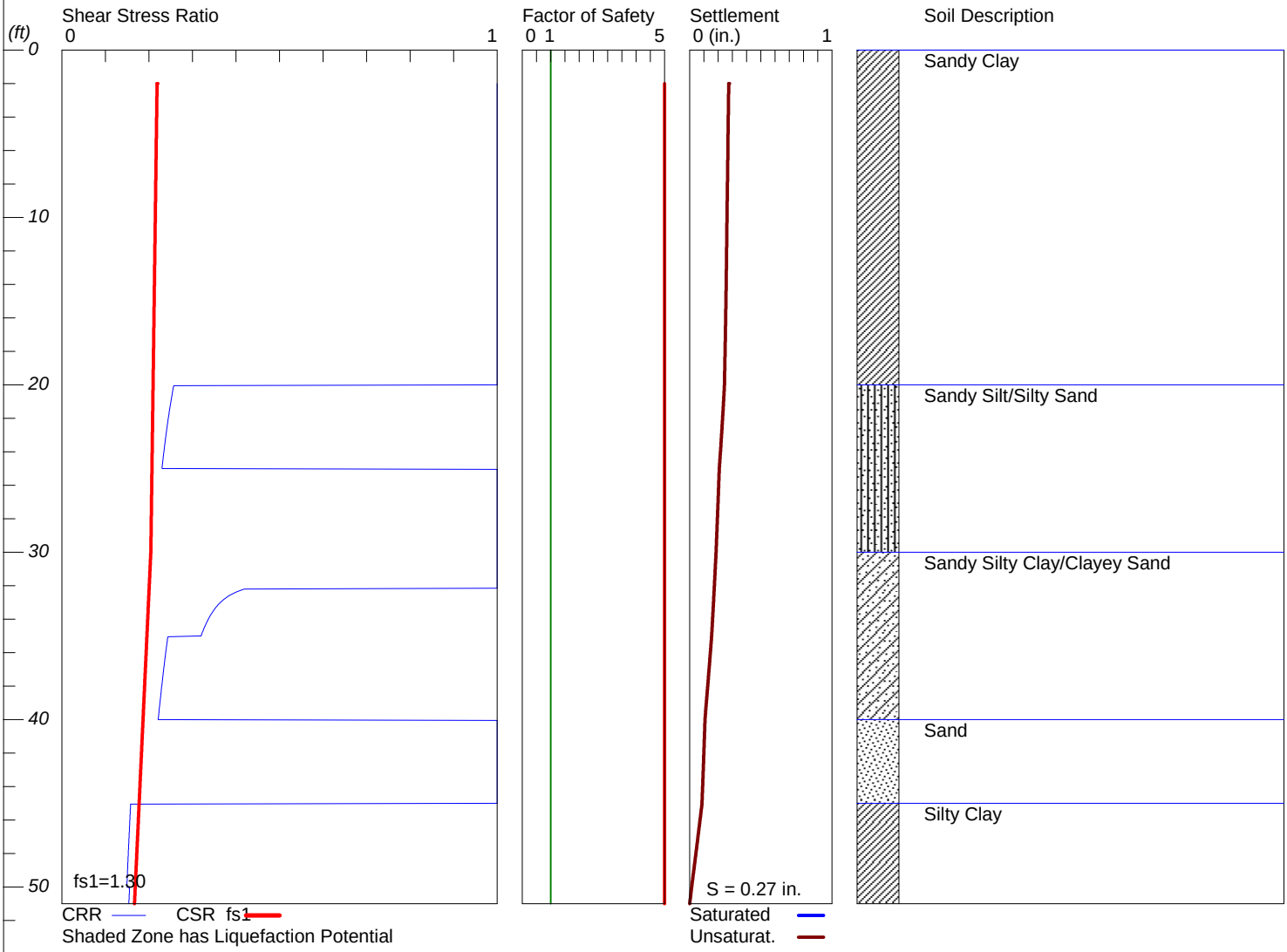
Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Geology\eq-location-map.mxd

LIQUEFACTION ANALYSIS

Grapevine Project

Hole No.=B-2 Water Depth=100 ft

Magnitude=7.9
Acceleration=0.26g



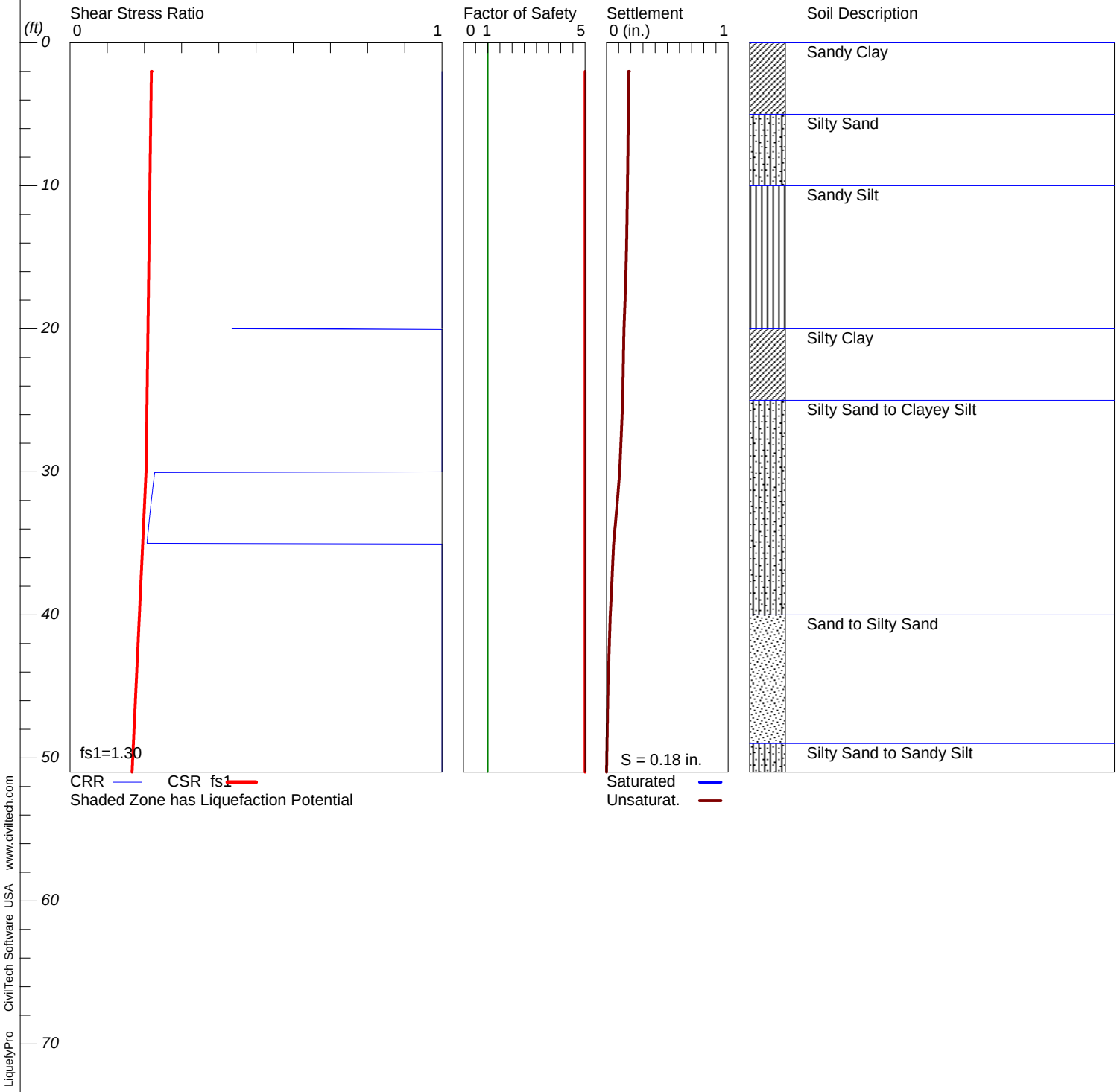
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

Grapevine Project

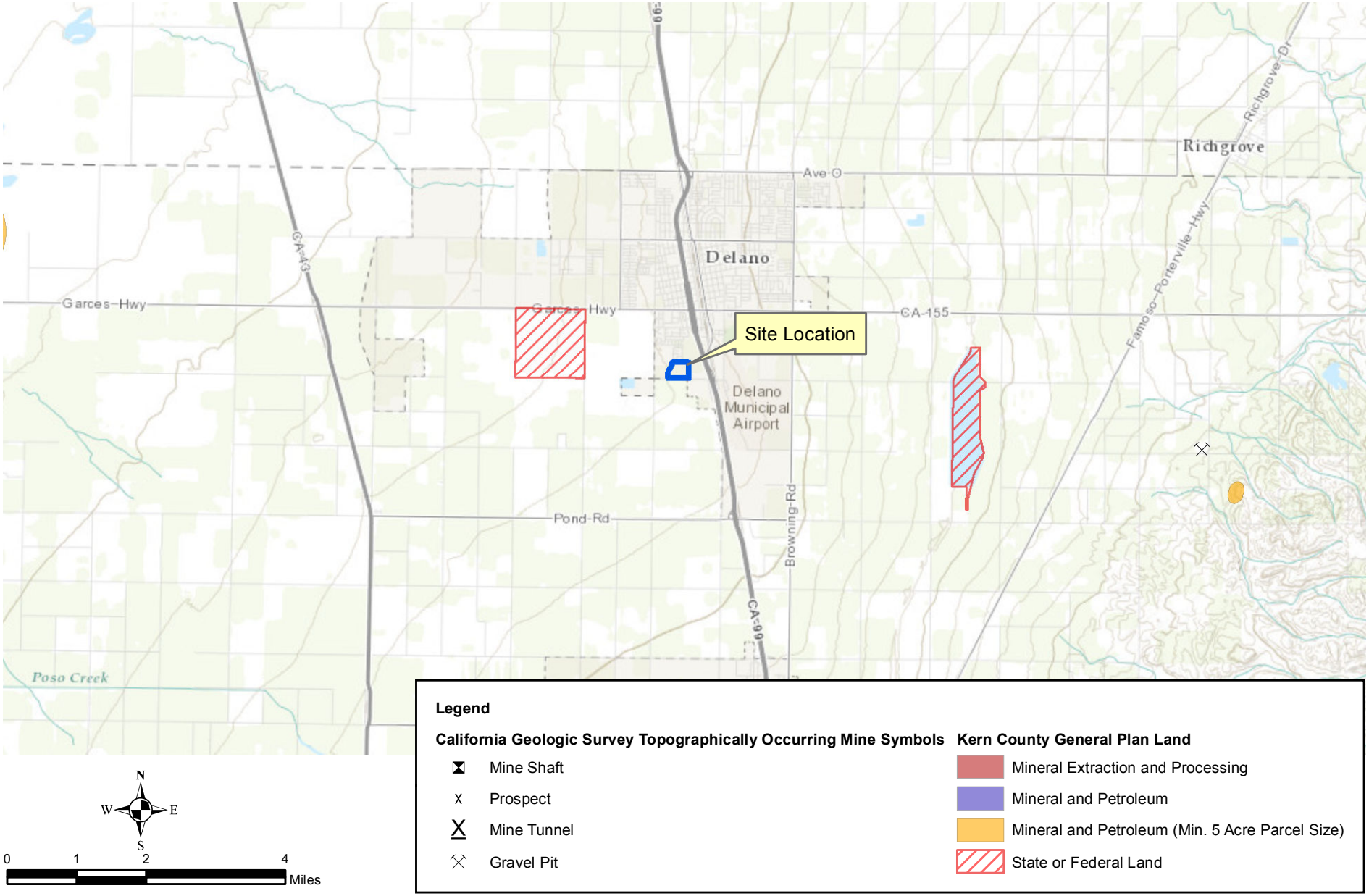
Hole No.=B-4 Water Depth=100 ft

Magnitude=7.9
Acceleration=0.26g



LiquefyPro CivilTech Software USA www.civiltech.com

Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Figure11-Minerals-map.mxd



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Source: Kern County General Plan GIS Files, California Geologic Survey TOMS GIS data

Map Date: 4/11/2013

Grapevine Shopping Center
NW Corner of Woollomes and S. Dover
Delano, California

Figure 12
Mineral Resources Map
BSK Project E1300901S

Liquefy Pro Summary Sheets

****

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: J:\Geotechnical\Open Projects\Grapevine - GeoSections\b-2.liq
Title: Grapevine Project
Subtitle:

Surface Elev.=
Hole No.=B-2
Depth of Hole= 51.00 ft
Water Table during Earthquake= 100.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration= 0.26 g
Earthquake Magnitude= 7.90

Input Data:
Surface Elev.=
Hole No.=B-2
Depth of Hole=51.00 ft
Water Table during Earthquake= 100.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration=0.26 g
Earthquake Magnitude=7.90
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 0.95
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
2.00	17.00	119.00	50.00
5.00	25.00	124.00	50.00
10.00	51.00	125.00	50.00
15.00	31.00	125.00	50.00
20.00	16.00	125.00	41.00
25.00	26.00	125.00	39.00
30.00	24.00	125.00	48.00
35.00	20.00	125.00	48.00
40.00	40.00	125.00	10.00
45.00	14.00	125.00	64.00
50.00	15.00	125.00	64.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.27 in.
Total Settlement of Saturated and Unsaturated Sands=0.27 in.
Differential Settlement=0.137 to 0.181 in.

```
*****************************************************************************************************
                                        LIQUEFACTION ANALYSIS SUMMARY
                                       Copyright by CivilTech Software
                                          www.civiltechsoftware.com
*****************************************************************************************************
      Font: Courier New, Regular, Size 8 is recommended for this report.
      Licensed to ,  4/10/2013      2:03:17 PM

      Input File Name: J:\Geotechnical\Open Projects\Grapevine - GeoSections\b-4.liq
      Title:  Grapevine Project
      Subtitle:

      Surface Elev.=
      Hole No.=B-4
      Depth of Hole= 51.00 ft
      Water Table during Earthquake= 100.00 ft
      Water Table during In-Situ Testing= 100.00 ft
      Max. Acceleration= 0.26 g
      Earthquake Magnitude= 7.90

 Input Data:
      Surface Elev.=
      Hole No.=B-4
      Depth of Hole=51.00 ft
      Water Table during Earthquake= 100.00 ft
      Water Table during In-Situ Testing= 100.00 ft
      Max. Acceleration=0.26 g
      Earthquake Magnitude=7.90
      No-Liquefiable Soils:   Based on Analysis

      1. SPT or BPT Calculation.
      2. Settlement Analysis Method: Tokimatsu/Seed
      3. Fines Correction for Liquefaction: Stark/Olson et al.*
      4. Fine Correction for Settlement: During Liquefaction*
      5. Settlement Calculation in: All zones*
      6. Hammer Energy Ratio,                                    Ce = 0.95
      7. Borehole Diameter,                                          Cb= 1.15
      8. Sampling Method,                                           Cs= 1.2
      9. User request factor of safety (apply to CSR) ,   User= 1.3
         Plot one CSR curve (fs1=User)
      10. Use Curve Smoothing: No
      * Recommended Options

      In-Situ Test Data:
      Depth   SPT     gamma   Fines
      ft              pcf     %
      ____________________________________
      2.00    22.00   97.00   53.00
      5.00    25.00   112.00  53.00
      10.00   23.00   121.00  53.00
      15.00   19.00   121.00  53.00
      20.00   38.00   121.00  57.00
      25.00   23.00   121.00  57.00
      30.00   16.00   121.00  49.00
      35.00   27.00   121.00  49.00
      40.00   41.00   121.00  10.00
      45.00   100.00  121.00  10.00
      50.00   100.00  121.00  46.00
      ____________________________________

Output Results:
      Settlement of Saturated Sands=0.00 in.
      Settlement of Unsaturated Sands=0.18 in.
      Total Settlement of Saturated and Unsaturated Sands=0.18 in.
      Differential Settlement=0.091 to 0.120 in.
```

APPENDIX A

Field Exploration

APPENDIX A

FIELD EXPLORATION

The field exploration at the Site was under the oversight of a BSK staff member. Six (6) borings were drilled at the site on March 19, 2013 using a truck-mounted hollow stem auger drill rig. The borings were drilled to depths ranging from 21.5 to 51.5 feet beneath the existing ground surface (bgs). The approximate locations of the test borings are indicated on the Site Plan, Figure 2.

The soil materials encountered in the test borings were visually classified in the field, and the logs were recorded during the drilling and sampling operations. Visual classification of the materials encountered in the test borings was made in general accordance with the Unified Soil Classification System (ASTM D 2488). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

Subsurface samples were obtained at the successive depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Sampler and a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler. The samplers were driven 18 inches using a 140-pound hammer dropped from a height of 30 inches by means of either an automatic hammer or a down-hole safety hammer. The number of blows required to drive the last 12 inches was recorded as the blow count (blows/foot) on the boring logs. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Soil samples were also obtained using the SPT Sampler lined with metal tubes, or unlined in which case the samples were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the excavated soil cuttings.

It should be noted that the use of terms such as “loose”, “medium dense”, “dense” or “very dense” to describe the consistency of a soil is based on sampler blow count and is not necessarily reflective of the in-place density or unit weight of the soils being sampled. The relationship between sampler blow count and consistency is provided in the following Tables A-1 and A-2 for coarse-grained (sandy and gravelly) soils and fine grained (silty and clayey) soils, respectively.

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half >#200	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half <#200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS , MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

Note: Dual symbols are used to indicate borderline soil classifications.

	Pushed Shelby Tube	RV	R-Value
	Standard Penetration Test	SA	Sieve Analysis
	Modified California	SW	Swell Test
	Auger Cuttings	TC	Cyclic Triaxial
	Grab Sample	TX	Unconsolidated Undrained Triaxial
	Sample Attempt with No Recovery	TV	Torvane Shear
CA	Chemical Analysis	UC	Unconfined Compression
CN	Consolidation	(1.2)	(Shear Strength, ksf)
CP	Compaction	WA	Wash Analysis
DS	Direct Shear	(20)	(with % Passing No. 200 Sieve)
PM	Permeability		Water Level at Time of Drilling
PP	Pocket Penetrometer		Water Level after Drilling (with date measured)

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
Unified Soil Classification System

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Figure A-1

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Bakersfield CA 93301
Telephone: 661.327.0671
Fax: 661.324.4218

LOG OF BORING NO. B-1

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		ML: SANDY SILT: Brown; slightly moist; with organics.										
		SC: CLAYEY SAND: Olive brown; fine grained; slightly moist. ...CLAYEY SAND MEDIUM DENSE SILTY SAND: Olive brown; fine grained; slightly moist.	■		24			109	7			
5		SM: DENSE SILTY SAND: Olive brown; fine grained; slightly moist.	■		19, 50/ 5"			109	16			
10		SP: MEDIUM DENSE SAND: Light olive brown; medium grained; slightly moist.	■		40			118	4			
15		… MEDIUM DENSE SAND: Light olive brown; medium to coarse grained; slightly moist; trace of fine gravel.	☒		28				2			
20		CL: STIFF SILTY CLAY: Olive brown; slightly moist; trace of fine to medium sand.	☒		23				26			
		End of boring.										
25												
30												
35												
40												
45												
50												
55												

Completion Depth: **21.5**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 21.5 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

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Bakersfield CA 93301
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Fax: 661.324.4218

LOG OF BORING NO. B-2

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		ML: SANDY SILT: Brown; slightly moist; with organics.										
		CL: HARD SANDY CLAY Light olive brown; fine grained; moist.	■		17			110	8			
		… HARD SANDY CLAY: Light olive brown; fine grained; moist.										
5		… HARD DENSE SANDY CLAY: Light olive brown; fine grained; slightly moist.	■		40			114	9			
10		… HARD SANDY CLAY: Light olive brown; fine grained; slightly moist.	■		23, 50/ 6"			109	15			
15		" "	☒		31		50		10			
20		SM/ML: MEDIUM DENSE SILTY SAND TO SANDY CLAYEY SILT: Yellowish brown; moist.	☒		16		41		16			
25		… MEDIUM DENSE SILTY SAND TO VERY STIFF SILT: Light olive brown; slightly moist; trace of sand.	☒		26		39		16			
30		SC: MEDIUM DENSE CLAYEY SAND TO STIFF SANDY SILTY CLAY: Light olive brown; moist; trace of sand and fine gravel.	☒		24				26			
35		…MEDIUM DENSE CLAYEY SAND TO STIFF SANDY SILTY CLAY: Yellowish brown; moist.	☒		20		48		24			
40		SP: DENSE SAND: Olive brown; fine grained; slightly moist.	☒		40				7			
45		CL: STIFF SILTY CLAY: Brown; moist.	☒		14		64		21			
50		… STIFF SILTY CLAY: Olive brown; moist.	☒		15				21			
		End of boring.										
55												

Completion Depth: **51.5**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 51.5 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

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Fax: 661.324.4218

LOG OF BORING NO. B-3

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		CL: SANDY, SILTY CLAY: ; slightly moist; with organics.										
		CL: VERY STIFF SANDY CLAY: Olive brown; fine grained; slightly moist.										
		… MEDIUM DENSE SILTY SAND: Olive brown; fine grained; slightly moist.										
5		SP: MEDIUM DENSE SAND: Olive brown; fine to medium grained; slightly moist; trace of silt.	■		44		54	99	16	27	18	9
10		… MEDIUM DENSE SAND: Olive brown; medium to coarse grained; slightly moist.	☒		28			108	2			
15		ML: HARD SILT: Light yellowish brown; moist; trace of sand and fine gravel.	☒		52				10			
20		CL: VERY STIFF SANDY CLAY: Olive brown; moist.	☒		38				20			
		End of boring.										
25												
30												
35												
40												
45												
50												
55												

Completion Depth: **21.5**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 21.5 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

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Bakersfield CA 93301
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LOG OF BORING NO. B-4

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		CL: SANDY CLAY: Brown; lightly moist; with organics. ...SANDY CLAY: Olive brown; fine to medium grained; slightly moist.	■		36			87	12			
5		SM: MEDIUM DENSE SILTY SAND: Light yellowish brown; fine to coarse grained; moist.	■		40		53	98	14	27	17	10
10		ML: HARD SANDY SILT: Olive brown; moist.	■		37			108	12			
15		… STIFF SILT: Light olive brown; fine to coarse grained; moist.	☒		19				7			
20		CL: VERY STIFF SANDY, SILTY CLAY: Yellowish brown; moist.	☒		38		57		20			
25		SM/ML: SILTY SAND TO STIFFSILT: Olive brown; moist.	☒		23				10			
30		… STIFF SANDY, CLAYEY SILT: Light brown; moist.	☒		16		49		18			
35		… VERY STIFF SILT: Olive brown; moist.	☒		27				26			
40		SP-SM: DENSE SAND WITH SILT: Light yellowish brown; fine grained; moist.	☒		41		10		11			
45		SM: VERY DENSE SILTY SAND: Light olive brown; fine grained; slightly moist.	☒		30, 50/ 6"				10			
50		SM/ML: SILTY SAND TO HARD SANDY, CLAYEY SILT: Light yellowish brown; moist.	☒		42, 50/ 2"		46					
		End of boring.										
55												

Completion Depth: **51.2**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 51.2 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

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Bakersfield CA 93301
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LOG OF BORING NO. B-5

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		ML: SANDY SILT: Slightly moist; with organics.										
		… VERY STIFF SANDY SILT: Olive brown; slightly moist.	■		20			112	5			
5		... HARD SANDY SILT: Olive brown; slightly moist.	■		35		48	107	7	20	16	4
10		SP: MEDIUM DENSE SAND: Light yellowish brown; coarse grained; dry.	■		17			106	1			
15		" "	☒		15				2			
20		… MEDIUM DENSE SAND: Light olive brown; fine to medium grained; moist.	☒		16				5			
		End of boring.										
25												
30												
35												
40												
45												
50												
55												

Completion Depth: **21.5**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 21.5 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

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Bakersfield CA 93301
Telephone: 661.327.0671
Fax: 661.324.4218

LOG OF BORING NO. B-6

Project Name: **Proposed Grapevine Project**

Location: **Delano, California**

Job Number: **E13 009 01S**

Plate

Surface El.:

Location:

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Samples	Sample Number	Penetration Blows / Foot	Pocket Penetrometer, TSF	% Passing No. 200 Sieve	In-Situ Dry Weight (pcf)	In-Situ Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
		SC: CLAYEY SAND: Yellowish brown; slightly moist; with organics.										
		…CLAYEY SAND : Yellowish brown; moist.	■		30			115	8			
		…CLAYEY SAND: Yellowish brown; moist.										
5		...MEDIUM DENSE SILTY SAND: Yellowish brown; fine to medium grained; moist.	■		37		29			28	16	12
10		ML: HARD SILT: Yellowish brown; moist.	■		49			102	23			
15		SP: MEDIUM DENSE SAND: Olive brown; fine to medium grained; slightly moist.	╳		15				2			
20		ML: STIFF SILT: Olive brown; slightly moist.	╳		15				14			
		End of boring.										
25												
30												
35												
40												
45												
50												
55												

Completion Depth: **21.5**
Date Started: **3/19/13**
Date Completed: **3/19/13**
Logged By: **D. Smith**
Checked By: **K. Schwartz**

Drilling Equipment and Method: Mobile B-61 w/ 8 inch Hollow Stem Auger

Remarks: Boring terminated at 21.5 feet. Boring backfilled with soil cuttings. Groundwater was not encountered.

APPENDIX B

Laboratory Testing Results

BSK

APPENDIX B

LABORATORY TESTING

Moisture-Density Tests

The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D 2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in general accordance with ASTM D 2937 test procedures. Test results are presented on the boring logs in Appendix A.

Direct Shear Tests

Three Direct Shear Tests were performed on an in-situ soil sample from a selected boring. The test was conducted to determine the soil strength characteristics. The standard test method is ASTM D 3080, Direct Shear Test for Soil under Consolidated Drained Conditions. The results of the direct shear tests are presented graphically on Figures B-1 through B-3.

Consolidation Tests

Three Consolidation Tests were performed on a relatively undisturbed soil sample to evaluate compressibility and collapse potential characteristics. The tests were performed in general accordance with ASTM D 2435. The samples were initially loaded under as-received moisture content to a selected stress level, were then saturated, and then incrementally loaded up to a maximum load of 5200 psf. The test results are presented on Figures B-4 through B-6.

Expansion Index Test

Six Expansion Index Tests were performed on a bulk soil sample in an area beneath planned building slab or foundations. The test was performed in general accordance with UBC Standard 18-2. The result of the test are presented on Figures B-7 through B-12.

Plasticity Index Tests

Four soil samples were tested for plasticity and liquidity characteristics by ASTM D 4318. The test results are provided on Figures B-13 and B-14.

Minus 200 Wash

Thirteen soil samples were tested for minus 200 wash by ASTM D 1140. The test results are provided on Figure B-15 and on the boring logs.

Soil Corrosivity

The results of chemical analyses performed on a selected soil sample using California Test Method 643 (for pH) and EPA Test Methods 300.0 (for soluble sulfate and chlorides) and 9045C (for pH), and ASTM G-187 for Minimum Soil Resistivity are presented in Table B-1 below.

Table B-1: Summary of Corrosion Test Results	
Sample Location	B-5 @ 0-5’ bgs
pH	7.75
Sulfate, ppm	ND
Chloride, ppm	ND
Minimum Resistivity, ohm-cm	2,900

BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B-1 @ 2 feet bgs	
DRY DENSITY (pcf):	109	
MOISTURE CONTENT (%):	7	
INTERNAL FRICTION ANGLE, φ (degrees)	26	
COHESION, c (ksf):	0.16	
TEST METHOD:	ASTM D-3080: DIRECT SHEAR TEST	

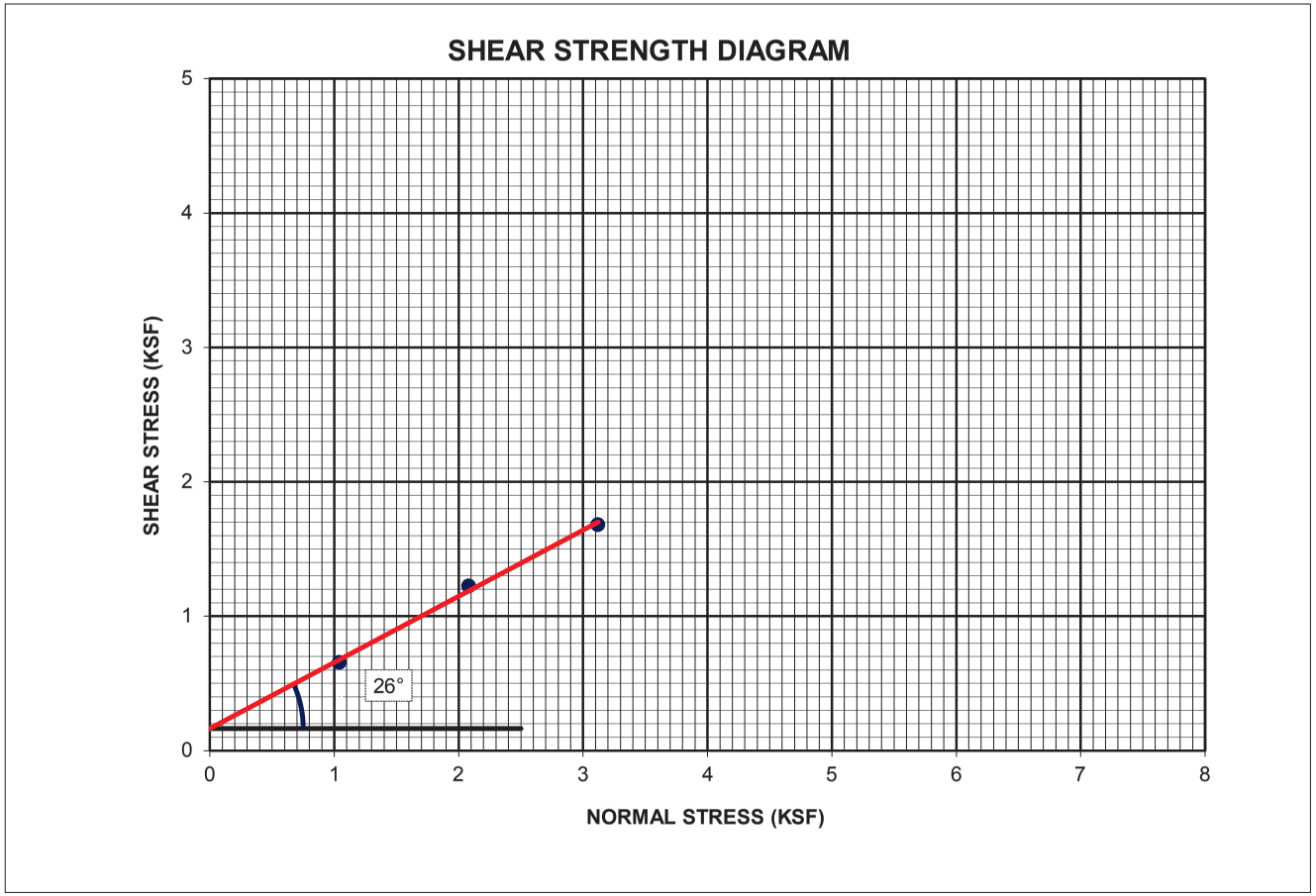

Figure B-1

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BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B-2 @ 2 feet bgs	
DRY DENSITY (pcf):	110	
MOISTURE CONTENT (%):	8	
INTERNAL FRICTION ANGLE, φ (degrees)	29	
COHESION, c (ksf):	0.09	
TEST METHOD:	ASTM D-3080: DIRECT SHEAR TEST	

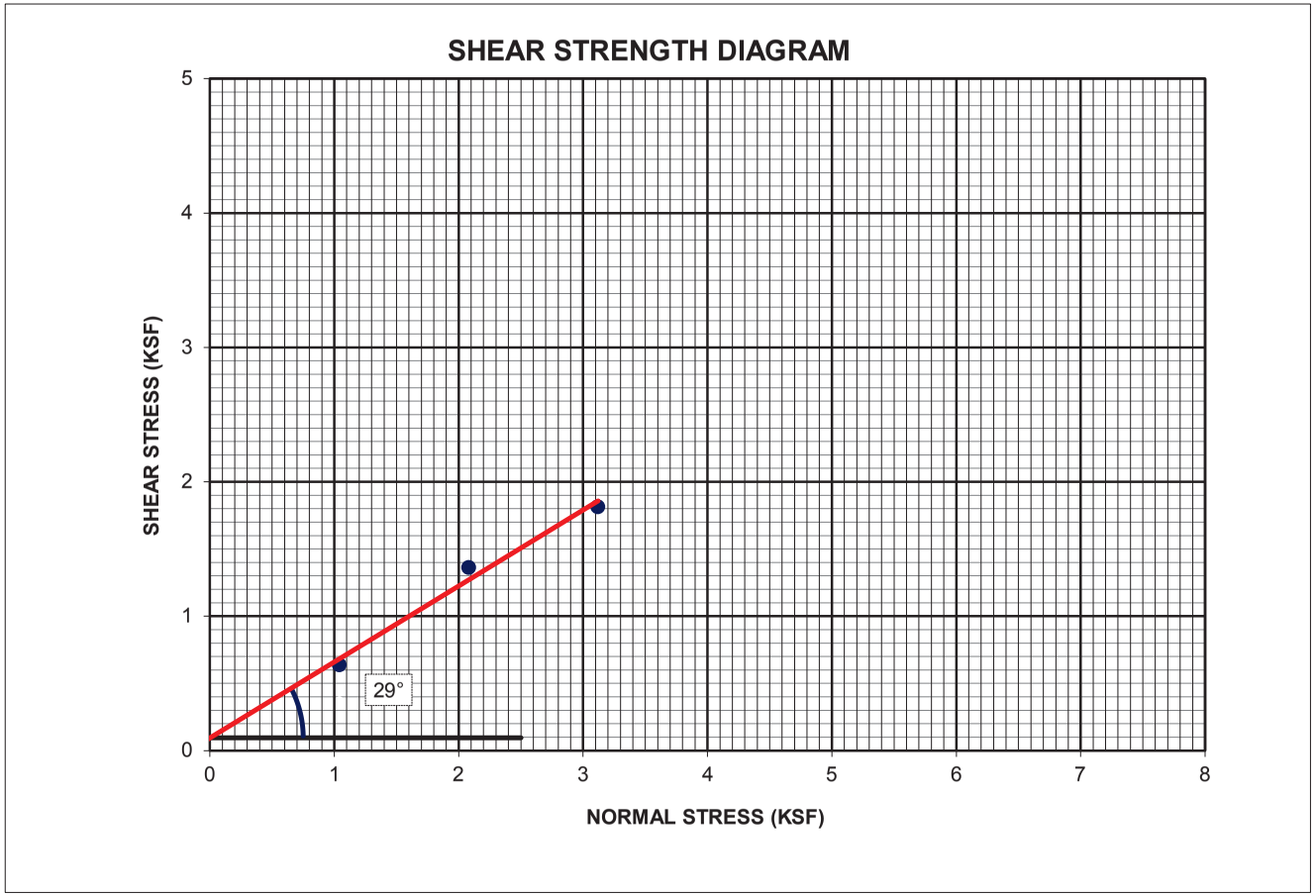

Figure B-2

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BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B-3 @ 2 feet bgs	
DRY DENSITY (pcf):	108	
MOISTURE CONTENT (%):	10	
INTERNAL FRICTION ANGLE, φ (degrees)	38	
COHESION, c (ksf):	0.49	
TEST METHOD:	ASTM D-3080: DIRECT SHEAR TEST	

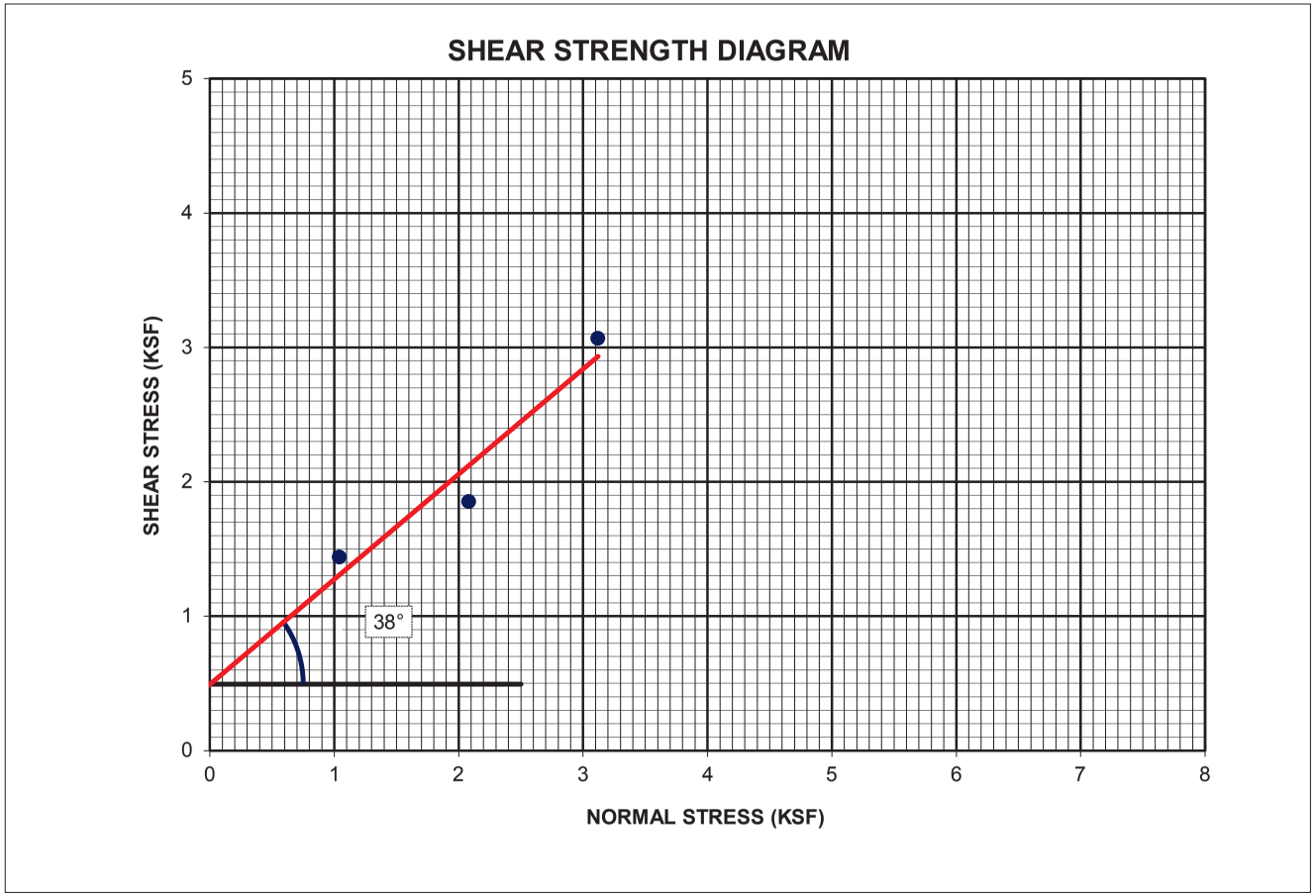

Figure B-3

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BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B- 4 @ 2 feet bgs	
DRY DENSITY (pcf):	87	
INITIAL MOISTURE CONTENT (%):	12	
COLLAPSE POTENTIAL:	-2.24 percent collapse at 1300 psf	
TEST METHOD:	ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION TEST	
PEAK LOAD (psf):	5200	

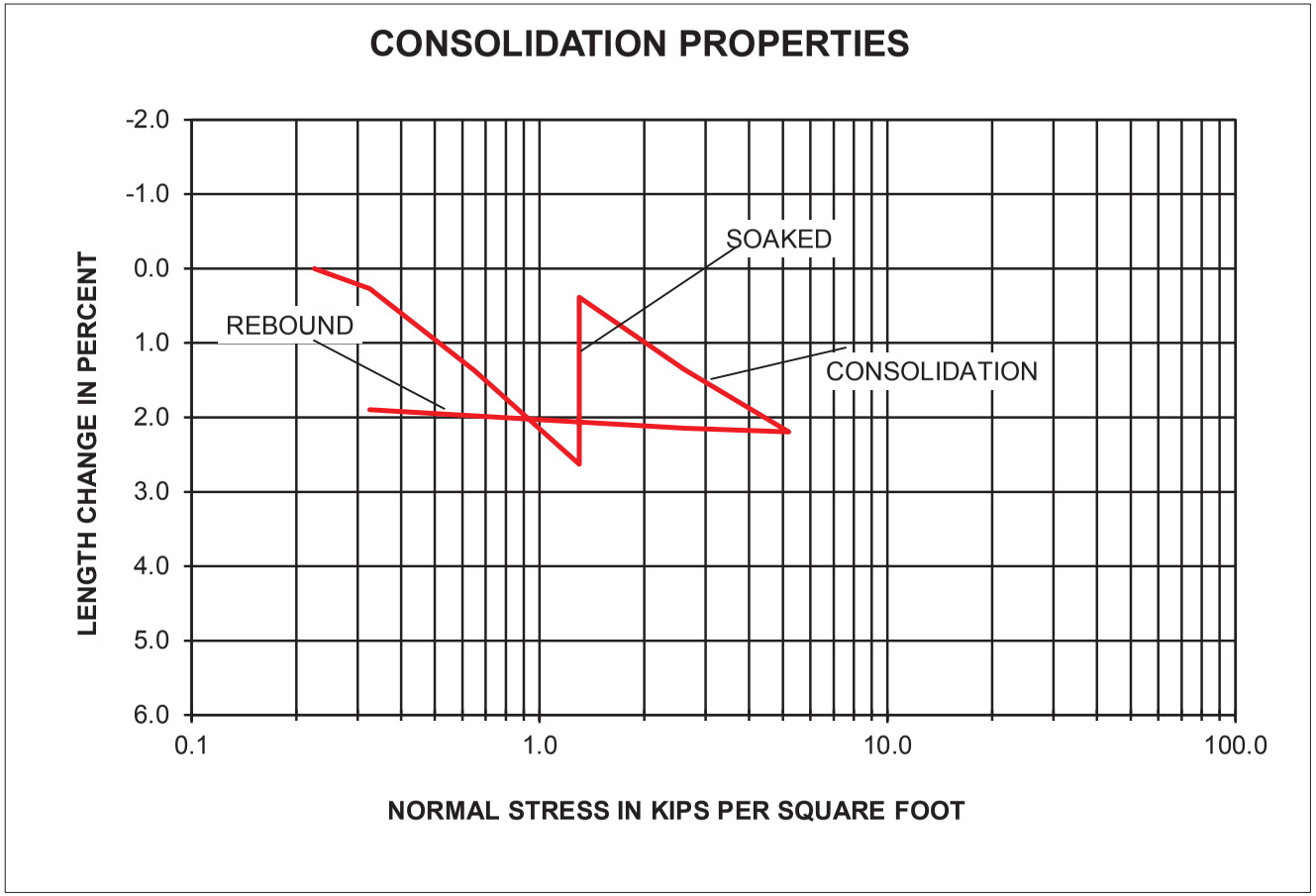

Figure B-4

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BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B- 5 @ 2 feet bgs	
DRY DENSITY (pcf):	112	
INITIAL MOISTURE CONTENT (%):	5	
COLLAPSE POTENTIAL:	-0.22 percent collapse at 1300 psf	
TEST METHOD:	ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION TEST	
PEAK LOAD (psf):	5200	

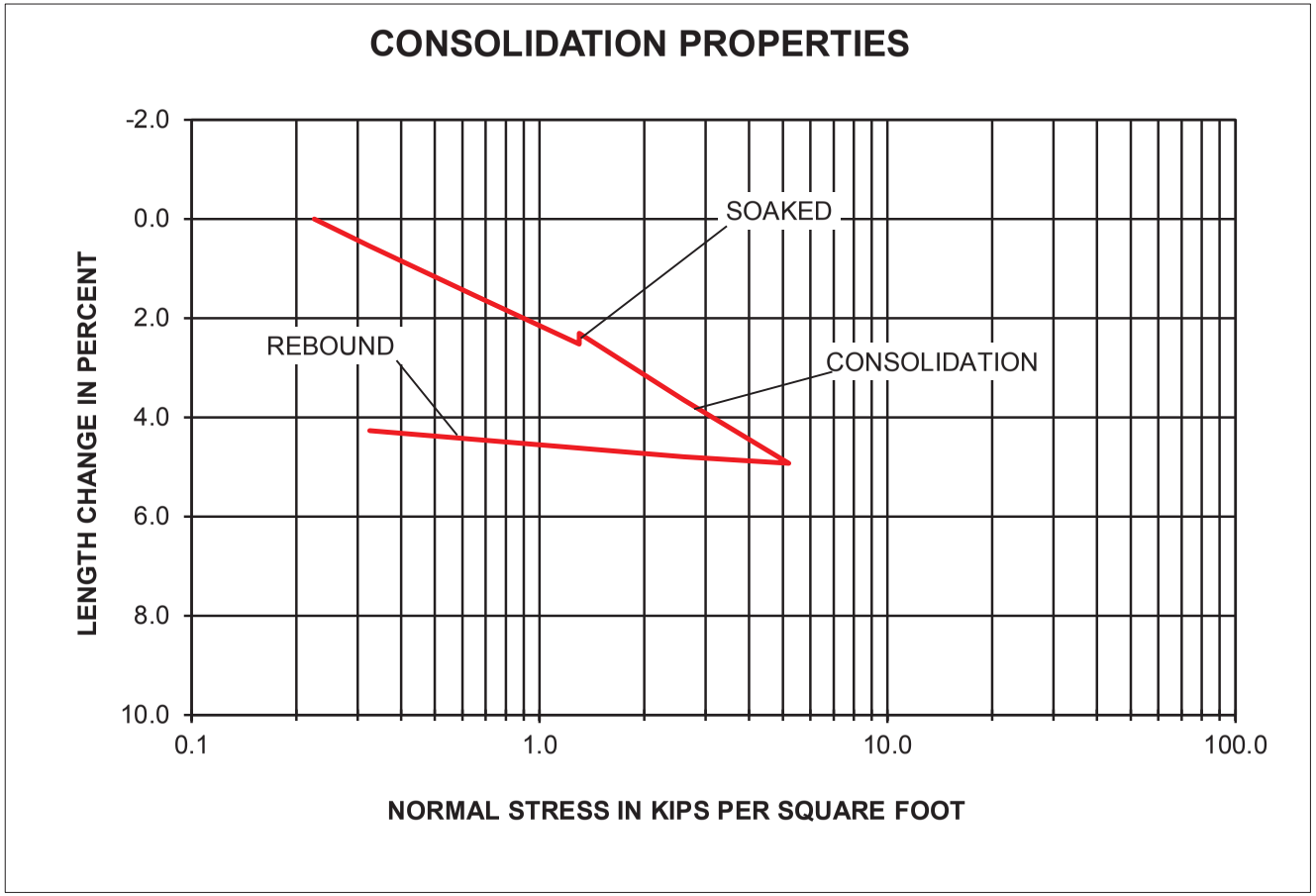

Figure B-5

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BSK PROJECT:	Proposed Grapevine Project	April 2013
PROJECT NUMBER:	E13-009-01S	
SAMPLE ID:	B- 6 @ 2 feet bgs	
DRY DENSITY (pcf):	115	
INITIAL MOISTURE CONTENT (%):	8	
COLLAPSE POTENTIAL:	-1.79 percent collapse at 1300 psf	
TEST METHOD:	ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION TEST	
PEAK LOAD (psf):	5200	

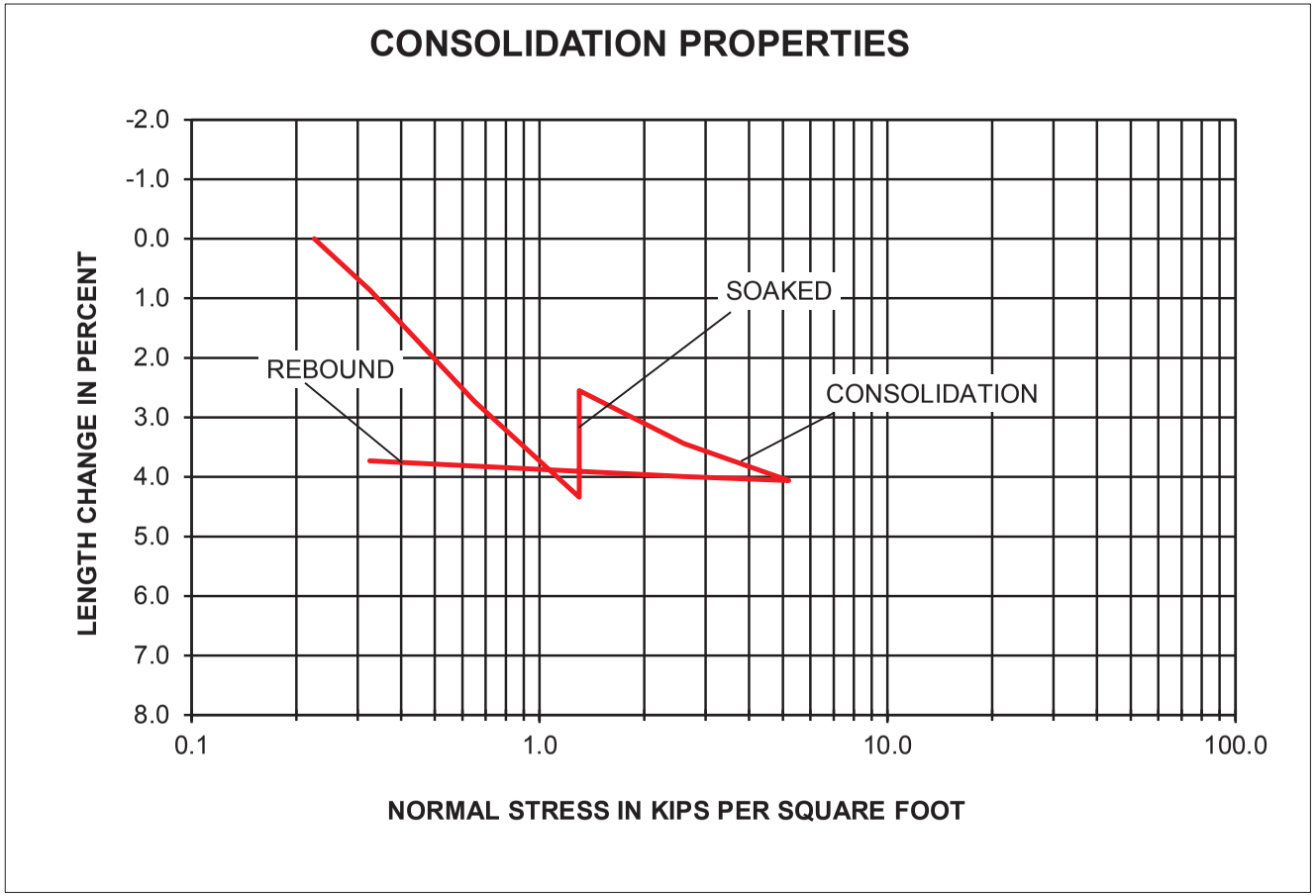

Figure B-6

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Proposed Grapevine Project
Project Number: E13 009 01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 4/5/2013
Sample Location: B-1 @ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** J. Walker **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	703.0	Sample + Tare Weight (g)	728.1
Tare Weight (g)	287.5	Tare Weight (g)	287.5
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	215.3	Wet Weight + Tare	728.1
Dry Weight + Tare	198.7	Dry Weight + Tare	699.8
Tare Weight (g)	0	Tare Weight (g)	287.5
Moisture Content (%)	8.4%	Moisture Content (%)	6.9%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007446
Remolded Wet Density (pcf)	126.0	Final Wet Density (pcf)	130.5
Remolded Dry Density (pcf)	116.3	Final Dry Density (pcf)	122.1
Degree of Saturation	**50**	**Degree of Saturation**	**49**

EXPANSION READINGS

Initial Gauge Reading (in)	0.2289
Final Gauge Reading (in)	0.2528
Expansion (in)	0.0239

Uncorrected Expansion Index	**24**
Corrected Expansion Index, EI	**24**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has low expansion potential.

Figure B-7

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Propose Grapevine Project
Project Number: E13 009 01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 4/5/2013
Sample Location: B-2 @ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** J. Walker **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	654.2	Sample + Tare Weight (g)	696.7
Tare Weight (g)	266.6	Tare Weight (g)	266.6
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	237.7	Wet Weight + Tare	696.7
Dry Weight + Tare	214.5	Dry Weight + Tare	607.2
Tare Weight (g)	0	Tare Weight (g)	266.6
Moisture Content (%)	10.8%	Moisture Content (%)	26.3%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007743
Remolded Wet Density (pcf)	117.5	Final Wet Density (pcf)	122.5
Remolded Dry Density (pcf)	106.0	Final Dry Density (pcf)	97.0
Degree of Saturation	**50**	**Degree of Saturation**	**96**

EXPANSION READINGS

Initial Gauge Reading (in)	0.1349
Final Gauge Reading (in)	0.1997
Expansion (in)	0.0648

Uncorrected Expansion Index	**65**
Corrected Expansion Index, EI	**64**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has medium expansion potential.

Figure B-8

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Proposed Grapevine Project
Project Number: E13-009-01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 4/4/2013
Sample Location: B-3@ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** I. Pacheco **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	706.0	Sample + Tare Weight (g)	741.2
Tare Weight (g)	309.8	Tare Weight (g)	309.8
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	211.4	Wet Weight + Tare	741.3
Dry Weight + Tare	192.3	Dry Weight + Tare	696.0
Tare Weight (g)	0	Tare Weight (g)	309.8
Moisture Content (%)	9.9%	Moisture Content (%)	11.7%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007620
Remolded Wet Density (pcf)	120.1	Final Wet Density (pcf)	124.8
Remolded Dry Density (pcf)	109.3	Final Dry Density (pcf)	111.7
Degree of Saturation	**49**	**Degree of Saturation**	**62**

EXPANSION READINGS

Initial Gauge Reading (in)	0.2551
Final Gauge Reading (in)	0.3029
Expansion (in)	0.0478

Uncorrected Expansion Index	**48**
Corrected Expansion Index, EI	**47**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has low expansion potential.

Figure B-9

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Proposed Grapevine Project
Project Number: E13-009-01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 3/29/2013
Sample Location: B-4 @ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** J. Walker **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	682.3	Sample + Tare Weight (g)	715.1
Tare Weight (g)	282.5	Tare Weight (g)	282.5
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	209.8	Wet Weight + Tare	715.1
Dry Weight + Tare	191.2	Dry Weight + Tare	630.1
Tare Weight (g)	0	Tare Weight (g)	282.5
Moisture Content (%)	9.7%	Moisture Content (%)	24.5%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007637
Remolded Wet Density (pcf)	121.2	Final Wet Density (pcf)	124.9
Remolded Dry Density (pcf)	110.5	Final Dry Density (pcf)	100.4
Degree of Saturation	**50**	**Degree of Saturation**	**97**

EXPANSION READINGS

Initial Gauge Reading (in)	0.242
Final Gauge Reading (in)	0.2921
Expansion (in)	0.0501

Uncorrected Expansion Index	**50**
Corrected Expansion Index, EI	**50**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has low expansion potential.

Figure B-10

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Proposed Grapevine Project
Project Number: E13-009-01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 3/30/2013
Sample Location: B-5 @ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** J. Walker **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	706.0	Sample + Tare Weight (g)	703.7
Tare Weight (g)	287.1	Tare Weight (g)	287.1
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	201.0	Wet Weight + Tare	703.7
Dry Weight + Tare	185.9	Dry Weight + Tare	651.8
Tare Weight (g)	0	Tare Weight (g)	287.1
Moisture Content (%)	8.1%	Moisture Content (%)	14.2%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007244
Remolded Wet Density (pcf)	127.0	Final Wet Density (pcf)	126.8
Remolded Dry Density (pcf)	117.5	Final Dry Density (pcf)	111.0
Degree of Saturation	**50**	**Degree of Saturation**	**74**

EXPANSION READINGS

Initial Gauge Reading (in)	0.1687
Final Gauge Reading (in)	0.1648
Expansion (in)	-0.0039

Uncorrected Expansion Index	**0**
Corrected Expansion Index, EI	**0**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has very low expansion potential.

Figure B-11

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EXPANSION INDEX OF SOILS

ASTM D 4829 / UBC STANDARD 18-2

Project Name: Proposed Grapevine Project
Project Number: E13-009-01S **Sample Date:** 3/19/2013
Lab Tracking ID: **Test Date:** 4/1/2013
Sample Location: B-6 @ 0' - 5'
Sample Source Native
Sampled By: D.Smith **Tested By:** J. Walker **Reviewed By:** A. Terronez

TEST DATA

INITIAL SET-UP DATA		FINAL TAKE-DOWN DATA	
Sample + Tare Weight (g)	691.0	Sample + Tare Weight (g)	736.6
Tare Weight (g)	287.5	Tare Weight (g)	287.5
Moisture Content Data		**Moisture Content Data**	
Wet Weight + Tare	214.0	Wet Weight + Tare	736.6
Dry Weight + Tare	195.5	Dry Weight + Tare	650.9
Tare Weight (g)	0	Tare Weight (g)	287.5
Moisture Content (%)	9.5%	Moisture Content (%)	23.6%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007483
Remolded Wet Density (pcf)	122.3	Final Wet Density (pcf)	132.3
Remolded Dry Density (pcf)	111.7	Final Dry Density (pcf)	107.1
Degree of Saturation	**50**	**Degree of Saturation**	**111**

EXPANSION READINGS

Initial Gauge Reading (in)	0.2462
Final Gauge Reading (in)	0.2752
Expansion (in)	0.029

Uncorrected Expansion Index	**29**
Corrected Expansion Index, EI	**29**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Remarks: The material has low expansion potential.

Figure B-12

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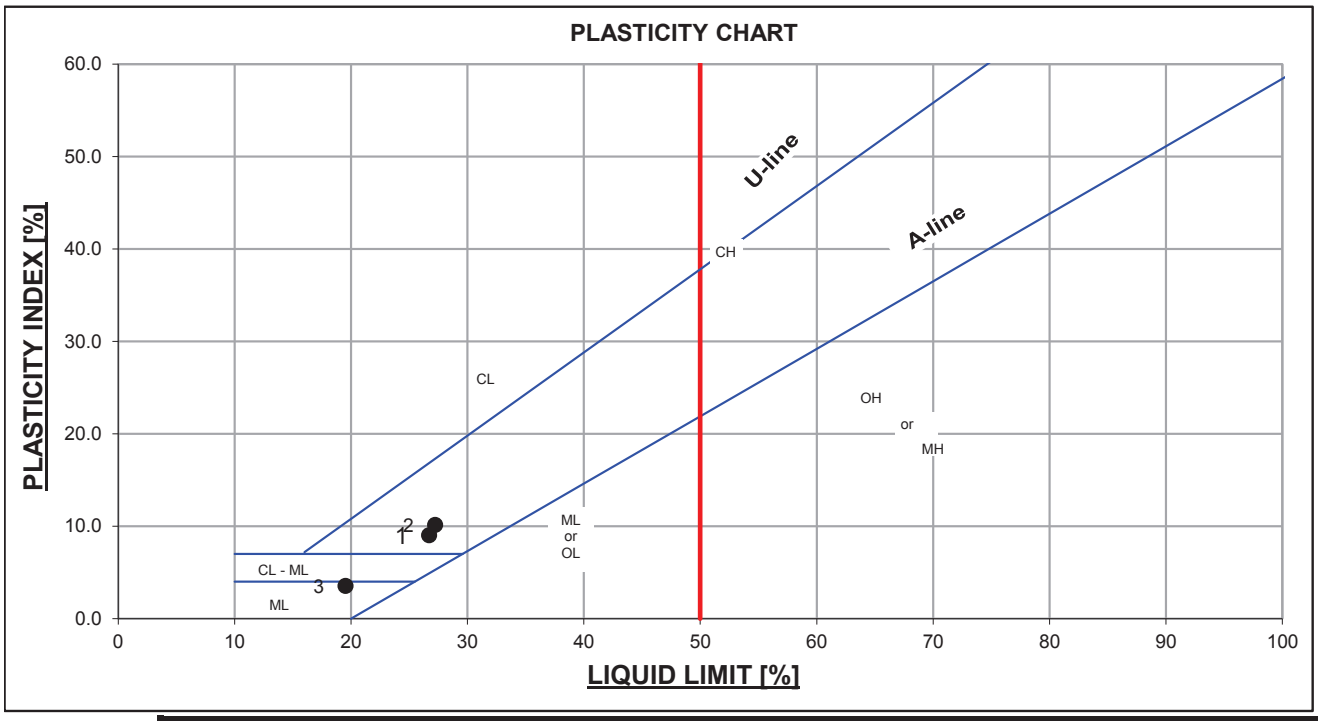
LIQUID LIMIT (LL), PLASTIC LIMIT (PL), AND PLASTICITY INDEX (PI) OF SOILS

ASTM D-4318

Project Name: Proposed Grapevine Project
Project Number: E13 009 01S
Sampled By: D.Smith **Tested By:** R. Donasco

Report Date: 4/3/2013
Sample Date: 3/19/2013
Test Date: 3/27/2013



Sample #	1			2			3		
Sample ID	B-3 @ 0-5'			B-4 @ 0-5'			B-5 @ 0-5'		
Location	Native			Native			Native		
Description	Silty Clay			Silty Clay			Sandy Silt		
Wet+Tare (g)	40.15	42.88	41.31	40.20	41.04	40.69	41.20	41.27	41.90
Dry+Tare (g)	38.12	40.20	38.87	38.10	38.73	38.43	39.46	39.46	39.98
Tare (g)	30.51	30.28	29.98	30.26	30.43	30.45	29.93	30.22	30.47
No. of Blows	28	23	18	34	20	16	34	26	23
LL	26.7	27.0	27.4	26.8	27.8	28.3	18.3	19.6	20.2
Corrected LL	27.0	26.7	26.4	27.8	27.1	26.8	19.0	19.7	20.0
Plastic Limit Data									
Wet+Tare (g)	39.09	40.10	40.08	39.40	40.10	38.78	39.28	41.14	39.76
Dry+Tare (g)	37.79	38.63	38.63	38.09	38.60	37.52	38.00	39.63	38.48
Tare (g)	30.47	30.31	30.41	30.27	30.29	29.87	30.00	30.26	30.42
M.C.	17.8	17.7	17.6	16.8	18.1	16.5	16.0	16.1	15.9

	Results	Specification	Results	Specification	Results	Specification
AVG L.L.	26.7		27.2		19.5	
AVG P.L.	17.7		17.1		16.0	
P.I.	9		10		4	
USCS Symbol	CL		CL		ML	

Remarks: ***USCS Symbol is for the material passing #40 Sieve. Medium and Coarse Sand is scalped***

Reviewed By: _____

Figure B-13

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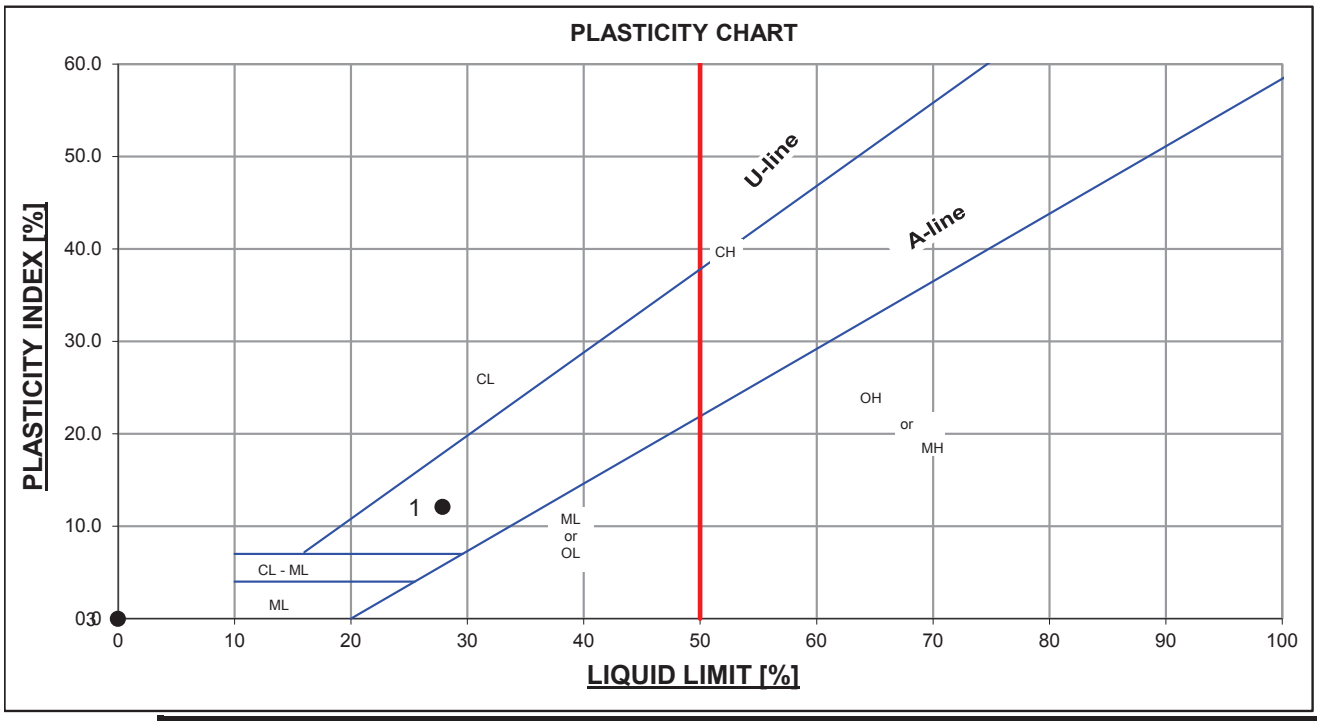
LIQUID LIMIT (LL), PLASTIC LIMIT (PL), AND PLASTICITY INDEX (PI) OF SOILS

ASTM D-4318

Project Name: Proposed Grapevine Project
Project Number: E13 009 01S
Sampled By: D.Smith **Tested By:** R. Donasco

Report Date: 4/3/2013
Sample Date: 3/19/2013
Test Date: 3/27/2013



Sample #	1								
Sample ID	B-6 @ 0-5'								
Location	Native								
Description	Silty Clay								
Wet+Tare (g)	39.37	39.94	41.08						
Dry+Tare (g)	37.39	37.89	38.64						
Tare (g)	30.09	30.58	30.08						
No. of Blows	31	24	21						
LL	27.1	28.0	28.5						
Corrected LL	27.8	27.9	27.9						
				Plastic Limit Data					
Wet+Tare (g)	39.34	25.02	24.24						
Dry+Tare (g)	38.11	23.73	23.08						
Tare (g)	30.17	15.67	15.76						
M.C.	15.5	16.0	15.8						
	Results	**Specification**		**Results**	**Specification**		**Results**	**Specification**	
AVG L.L.	27.9								
AVG P.L.	15.8								
P.I.	12								
USCS Symbol	CL								

Remarks: ***USCS Symbol is for the material passing #40 Sieve. Medium and Coarse Sand is scalped***

Reviewed By: _____

Figure B-14

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FIGURE B-15

Minus 200 Wash Report
ASTM D-1140

Project Name: Proposed Grapevine Project
Project Number: E13 009 01S
Lab Tracking ID:
Sampled By: D. Smith

Report Date: 4/5/2013
Sample Date: 3/19/2013
Test Date: 3/30/2013
Tested By: A. Bartole

Sample Designation	Before Wash			After Wash		Moisture Content (%)	Percentage Passing (%)	Sample Description
	Wet Wt.	Dry Wt.	Tare Wt.	Dry Wt.	Tare Wt.			
B-2 @ 15'	494.9	451.3	0	227.8	0	9.7%	50%	CL
B-2 @ 20'	416.5	360.4	0	212.3	0	15.6%	41%	SM/ML
B-2 @ 25'	462.8	397.5	0	244.2	0	16.4%	39%	SM/ML
B-2 @ 35'	474.6	382.9	0	199.7	0	23.9%	48%	SC
B-2 @ 45'	335.1	276.6	0	99.8	0	21.1%	64%	CL
B-3 @ 0-5'	507.1	463.8	0	212.6	0	9.3%	54%	CL
B-4 @ 20'	406.1	339	0	147.2	0	19.8%	57%	CL
B-4 @ 30'	544.1	456	0	233.9	0	19.3%	49%	SM/ML
B-4 @ 40'	426.3	411.8	0	370.4	0	3.5%	10%	SP-SM
B-4 @ 50'	499.5	444.7	0	238.3	0	12.3%	46%	SM/ML
B-4 @ 0-5'	494.5	457.1	0	213.7	0	8.2%	53%	CL
B-5 @ 0-5'	488.8	455.2	0	237.6	0	7.4%	48%	ML
B-6 @ 0-5'	452.2	430.9	0	307.8	0	4.9%	29%	SC

Remarks:

Reviewed By: _____

APPENDIX 3.8

HYDROLOGY AND WATER QUALITY STUDIES

MEMORANDUM

Project:	Grapevine Development
Subject:	Hydraulic Modeling Summary
Date:	November 25, 2013
To:	Mimi Chang, YK America Group Martin Hsu, YK America Group
From:	David S. Smith, P.E., WEST Consultants, Inc.

REGISTERED PROFESSIONAL ENGINEER
David S. Smith
No. C056132
EXP. 12/31/14
CIVIL
STATE OF CALIFORNIA

Introduction

This memo summarizes the hydraulic analysis completed by WEST Consultants, Inc. (WEST) for the YK America Group to determine the 1-percent annual chance exceedance (100-year) water surface elevations in the vicinity of the proposed Grapevine development in the City of Delano, Kern County, California. The Grapevine site is north of Woollomes Avenue, east of Albany Street, and west of the Delano Marketplace. The site plan for the proposed project is shown in Figures 1 and 2. The following is the project description:

> The project applicant submitted to the City an application for an approximately 328,500 square foot shopping center. The proposed project would include a 12-screen theater; a lifestyle component to include retail shops and restaurants (sit-down and fast-food); midsize retailers between 10,000 to 25,000 square feet and outparcels for fast food; and drive through and sit down restaurants, with proposed building sizes ranging from 2,500 to 10,000 square feet. The height of the majority of the buildings at the project site would fall between 20 and 40 feet with some buildings reaching a height of 50 feet for an architectural feature. Illuminated signs of up to 80 feet in height will also be used to publicize the proposed shopping center.

A portion of the Grapevine site was previously modeled by WEST in two Delano Marketplace LOMR application studies. The first Delano Marketplace LOMR application was for Walmart only and has been processed and approved by FEMA. The second LOMR application is still in process and will include the McDonalds, Panda Express, and Anchor 2 developments within the Delano Marketplace. The fine grid FLO-2D model used to evaluate the second LOMR request is a modified version of the model submitted with the first LOMR request. The fine grid model limits for the second LOMR request were significantly expanded from the immediate Delano Marketplace vicinity to include

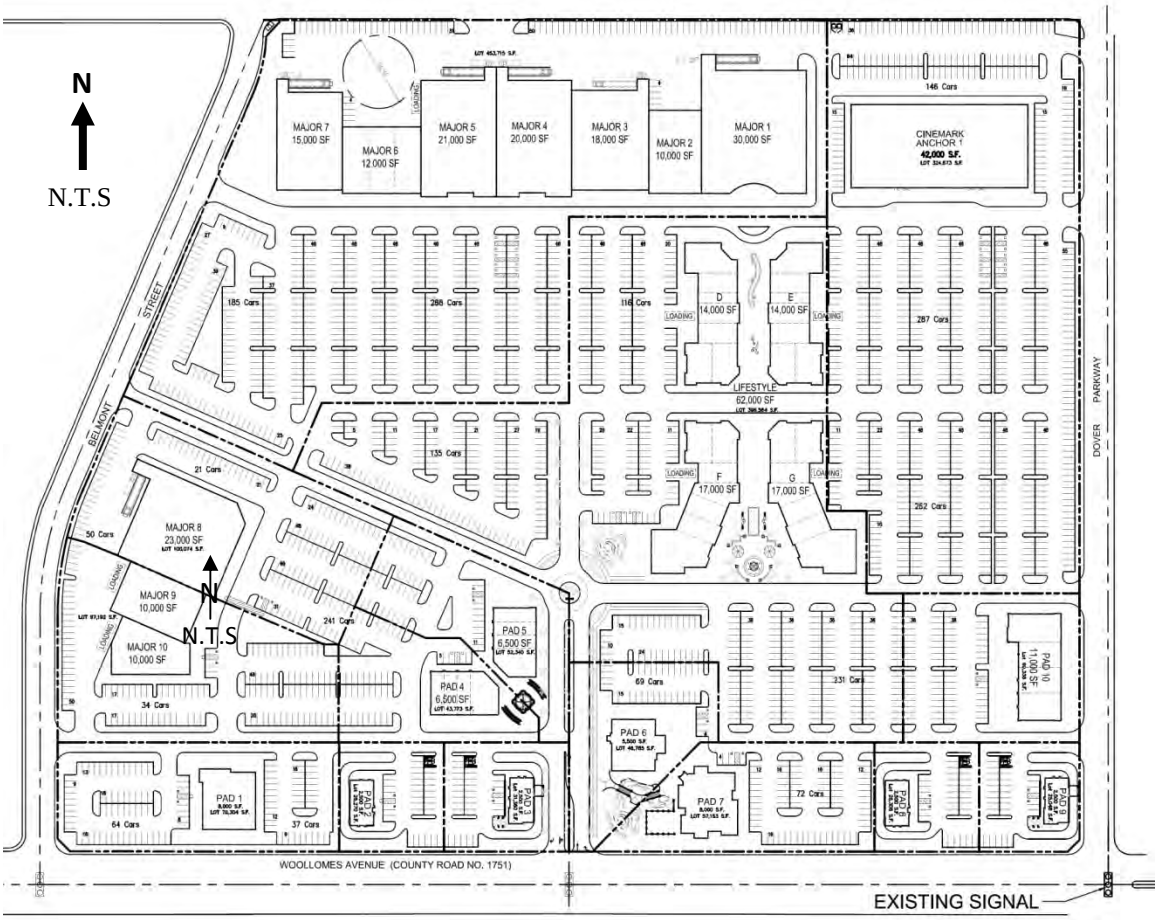


Figure 1. Grapevine Development

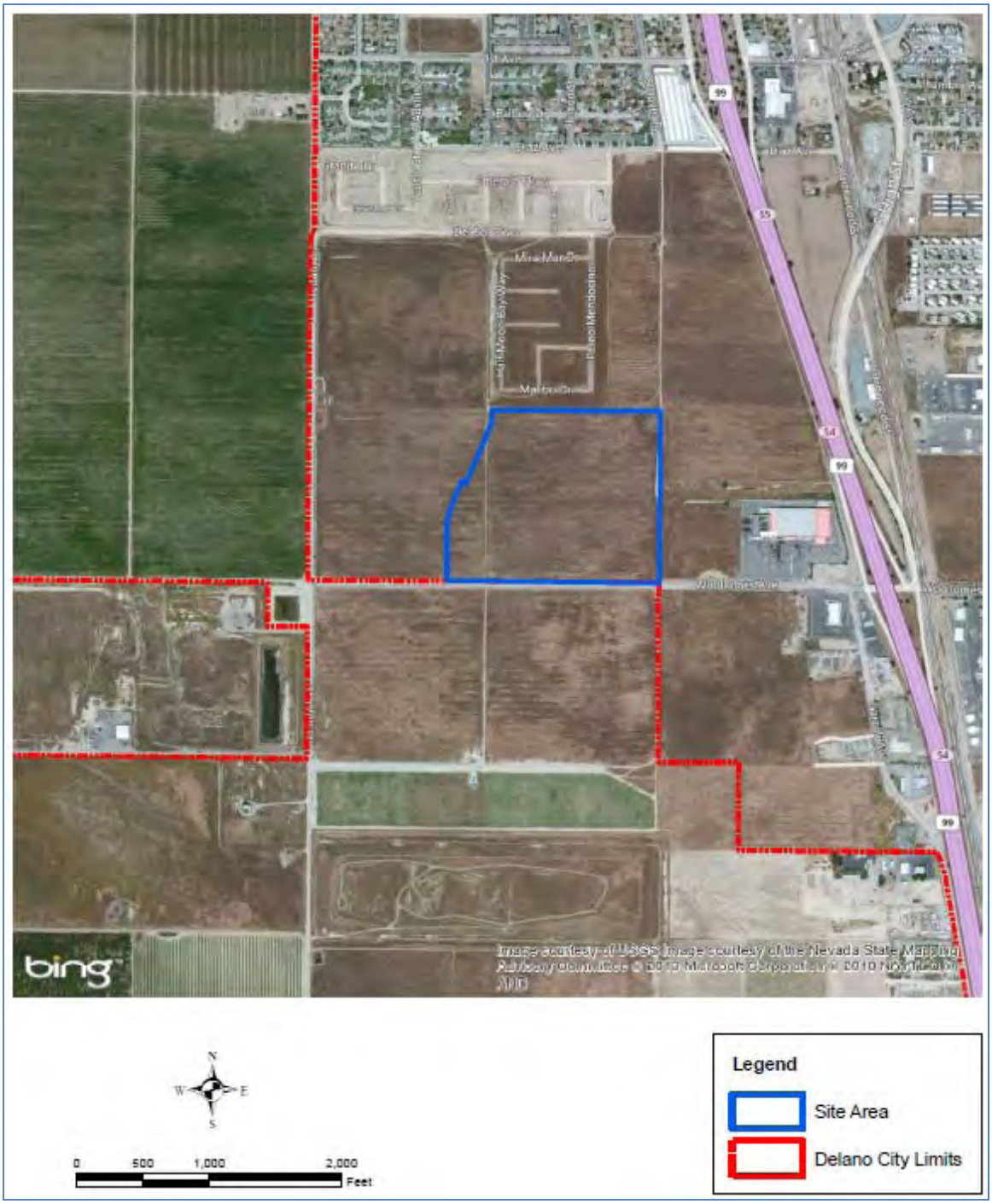


Figure 2. Grapevine Site Location

more detail to the east, north, and south. The 3.5-foot high barrier along Highway 99 separating northbound and southbound lanes was included to provide a more realistic flow path for the 100-year event. This revised model has been used to evaluate the Grapevine site along with a few additional modifications described below.

FLO-2D Model Revisions

The FLO-2D model was extended approximately 1,300 feet west of Albany Street. The coarse grid model was not modified. Existing conditions and proposed conditions models were created to evaluate the Grapevine site. Existing conditions model topography of the Grapevine site consists of survey data provided by Cornerstone Engineering. The existing conditions topography in the vicinity of Delano Marketplace was assumed to include the Walmart, McDonalds, Panda, and Anchor 2 developments. Outside of the Grapevine and Delano Marketplace parcel boundaries, Intermap topography was used for the fine grid model.

The proposed conditions model includes the Grapevine Development described in Figures 1 and 2. Although the area between the west end of the proposed Grapevine development and Albany Street has not been planned, WEST has assumed that this entire area is "blocked off" from flow. This assumption will provide conservatively high flow depths around the perimeter of the project for planning purposes. This scenario is somewhat unrealistic because fill is not proposed throughout the site (only the building pads will be elevated) and the future site design could accommodate a small amount of flow down streets, alleys, walkways, parking lots, etc., which would lower the flow depths surrounding the project site. Interpretation of specific results around the perimeter of the site is provided below.

Results

A regional view of the 100-year simulation is shown in Figure 3 to provide some context of the flow patterns at the site. Flow directional arrows have been added to the graphic for clarification and should be considered approximate. Model results are shown for existing conditions at the Grapevine site (shown in Figure 3 with the solid black outline). For the proposed conditions model, the area blocked from flow includes both the Grapevine site (solid black line) and the area to the east (dashed black line).

As seen in Figure 3, the majority of the flow in the vicinity of the Grapevine development is south of the site, flowing from east to west. A small amount of flow approaches the Grapevine site from the north, south, and east. Existing condition results are provided in greater detail in a map book format in Exhibit 1 and proposed conditions results are shown in Exhibit 2. The differences between proposed and existing conditions are shown in Exhibit 3. In each exhibit, model cells subjected to rainfall only and/or cells that have ponding depths less than 0.05 feet are not shown. The aerial image will be all that is seen in these areas.

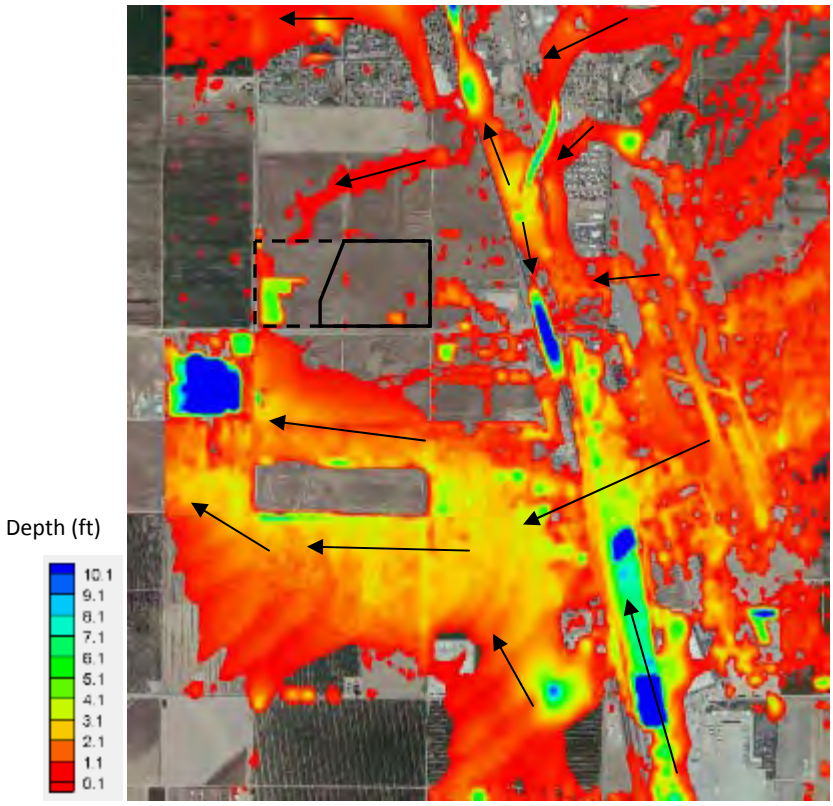


Figure 3. 100-year FLO-2D Results in Vicinity of Grapevine Site

A review of each portion of the site perimeter shown in Exhibits 1, 2, and 3 is summarized below:

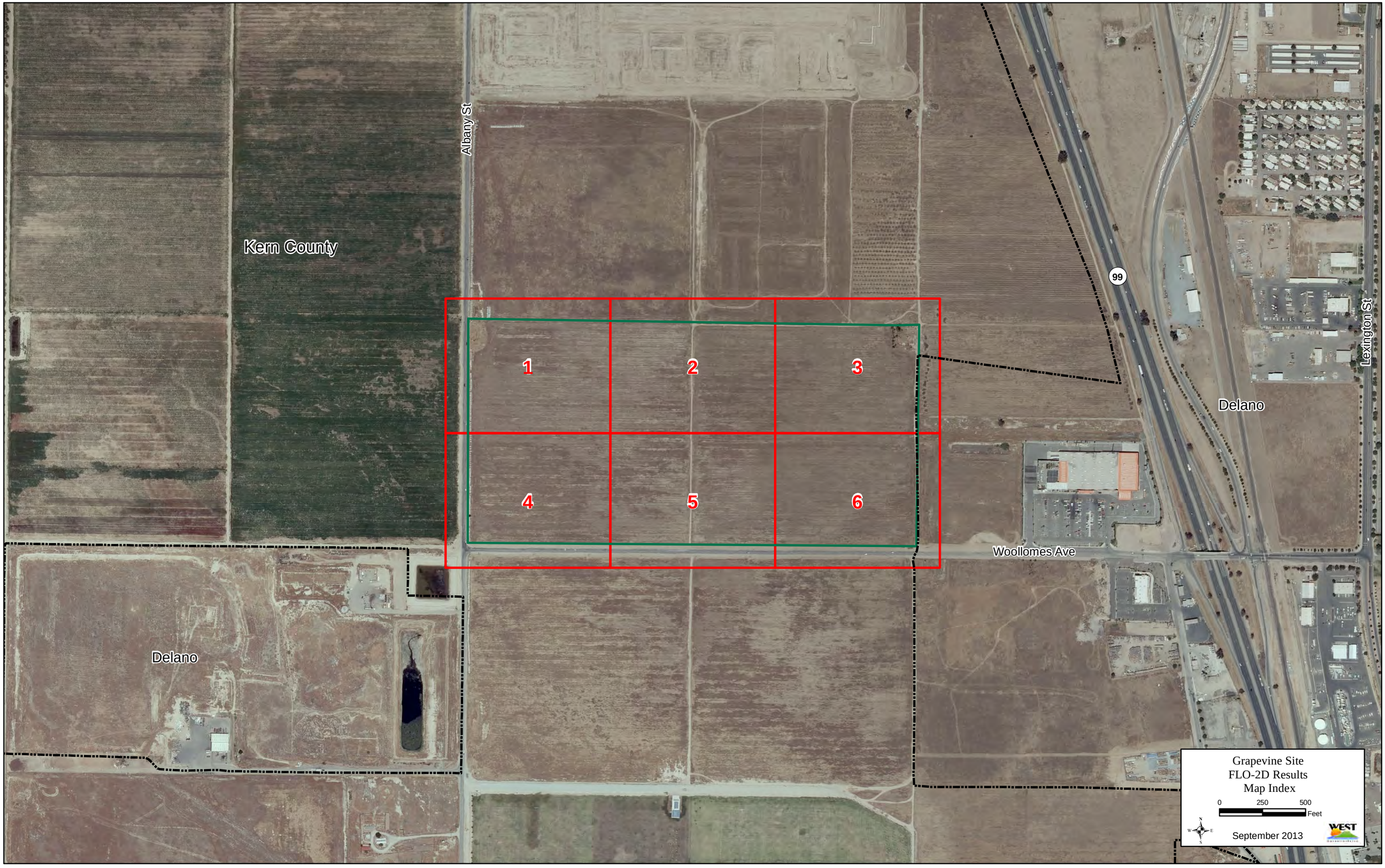
1. Sheet 1 of 6 (northwest corner). The flow from the north shown in Figure 3 comes to this area (top of sheet 1 of 6). In existing conditions flow generally continues southwest, but in proposed conditions the existing flow path is assumed blocked, forcing additional flow around the northwest corner. This results in a depth increase of up to 0.65 feet between existing and proposed conditions. However, this is **not considered significant** because the future site will be designed to account for this flow path by including a street or other flow path to direct the flow through the site. Until that future development happens there would not be a flow blockage with the current project and the flow path would be similar to existing conditions in this area. The model results reflect some ponding near the northwest corner up to 2.3 feet in existing conditions and 3.1 feet in proposed conditions, but these depths reflect ponded water with nearly zero velocity. As discussed above, the ponding will not actually increase as reflected in the model because the north flow path will be accounted for in the site design of future projects.
2. Sheet 2 of 6 (middle, north). There are three locations where the existing conditions model results touch the site boundary with depths less than a half

foot. These areas are **not considered significant** because the ponded water has nearly zero velocity (local depressions) and the ponding depths are less than a foot and therefore are not considered to be flooding hazards by FEMA. The increases shown with proposed conditions in Exhibit 3 in the northwest corner of Sheet 2 are due to the north flow path discussed above in item 1.

3. Sheet 3 of 6 (northeast corner). Along the north project boundary, the increase with proposed conditions is due to the north flow path (see item 1). This increase is **not considered significant** for the reasons described in item 1. Along the east project boundary, the model results reflect a maximum increase of 0.23 feet because flow to the west is assumed blocked in proposed conditions. This is **not considered significant** because the maximum depth in the proposed conditions is 0.33 feet which would probably not reach the site due to interception by curbs/gutters along Dover Parkway, and depths less than 1 foot are not considered to be flooding hazards by FEMA.
4. Sheet 4 of 6 (southwest corner). Along the west edge, the increases are **not considered significant** due to the conservative modeling assumptions regarding the north flow path discussed in item 1. Along the south edge, the increases up to 0.11 feet are due to the main body of flow south of the site, generally moving east to west, that is slightly constricted in proposed conditions near Albany Street and Woollomes Avenue. However, this is **not considered significant** because this area has not yet been developed and the constriction does not yet exist. The future site design should be designed to account for this potential constriction by including a parking lot, street, or other flow path at this corner of the site.
5. Sheet 5 of 6 (middle, south). The south boundary is wet at one cell in existing conditions but this is **not considered significant**. The area is not wet in proposed conditions.
6. Sheet 6 of 6 (southeast corner). The existing conditions model includes a ponding area in the southeast corner of the project, north of Woollomes Avenue. Water is delivered to this ponding area by rainfall and by shallow sheet flow less than 0.1 feet deep. In the proposed conditions model, flow from the east is assumed blocked resulting in higher depths than would actually occur along the east project boundary (maximum depth of 0.63 feet). This increase is **not considered significant** because water would either be collected in Dover Parkway itself or sheet flow west into the Grapevine shopping entrance about 400 feet north of Woollomes Avenue. If water moves west into the parking lot area, there would not be a significant flooding hazard due to the shallow nature of the flow (less than 0.1 feet deep). The ponding east of the project increases up to 0.33 feet with proposed conditions, however, this increase is **not considered significant** because the velocity of the ponded water is nearly zero and there would likely be an outlet in Dover Parkway and/or the Grapevine shopping entrance 400 feet north of Woollomes Avenue resulting in less ponding east of the site.

Exhibit 1

Existing Conditions
100-year Depth and Water Surface Elevation


Kern County
Albany St
99
Lexington St
Delano
Woollomes Ave
Delano
1
2
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4
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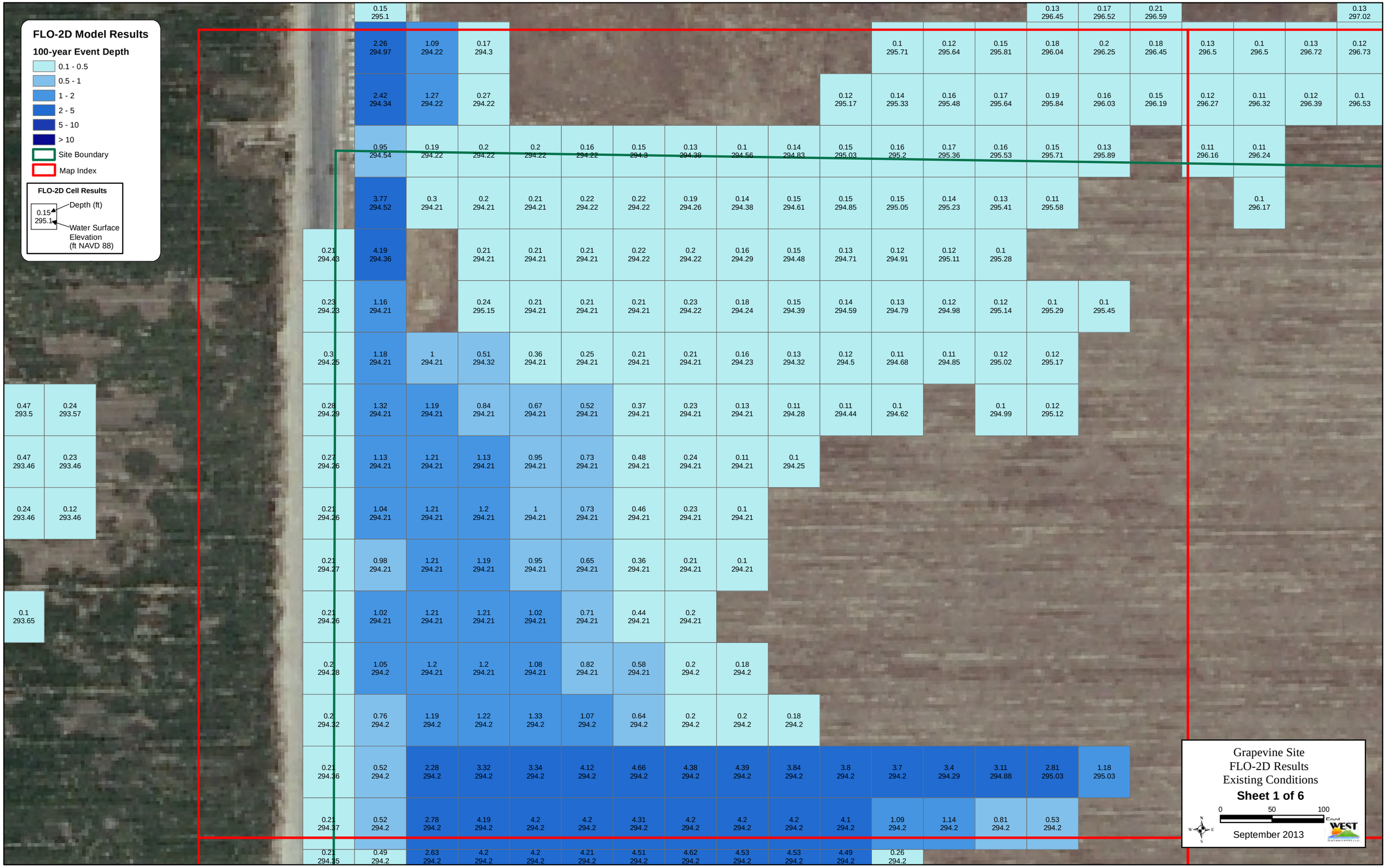
6
Grapevine Site
FLO-2D Results
Map Index
0
250
500
Feet
September 2013


FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.15 295.1
0.13 296.45
0.17 296.52
0.21 296.59
0.13 297.02
2.26 294.97
1.09 294.22
0.17 294.3
0.1 295.71
0.12 295.64
0.15 295.81
0.18 296.04
0.2 296.25
0.18 296.45
0.13 296.5
0.1 296.5
0.13 296.72
0.12 296.73
2.42 294.34
1.27 294.22
0.27 294.22
0.12 295.17
0.14 295.33
0.16 295.48
0.17 295.64
0.19 295.84
0.16 296.03
0.15 296.19
0.12 296.27
0.11 296.32
0.12 296.39
0.1 296.53
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0.19 294.22
0.2 294.22
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0.16 294.22
0.15 294.3
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0.16 295.53
0.15 295.71
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0.11 296.24
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0.21 294.21
0.22 294.22
0.22 294.22
0.19 294.26
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0.15 294.85
0.15 295.05
0.14 295.23
0.13 295.41
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0.1 296.17
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0.21 294.21
0.21 294.21
0.22 294.22
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0.24 295.15
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0.13 294.79
0.12 294.98
0.12 295.14
0.1 295.29
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0.3 294.25
1.18 294.21
1 294.21
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0.36 294.21
0.25 294.21
0.21 294.21
0.21 294.21
0.16 294.23
0.13 294.32
0.12 294.5
0.11 294.68
0.11 294.85
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0.11 294.44
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Grapevine Site
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Sheet 1 of 6
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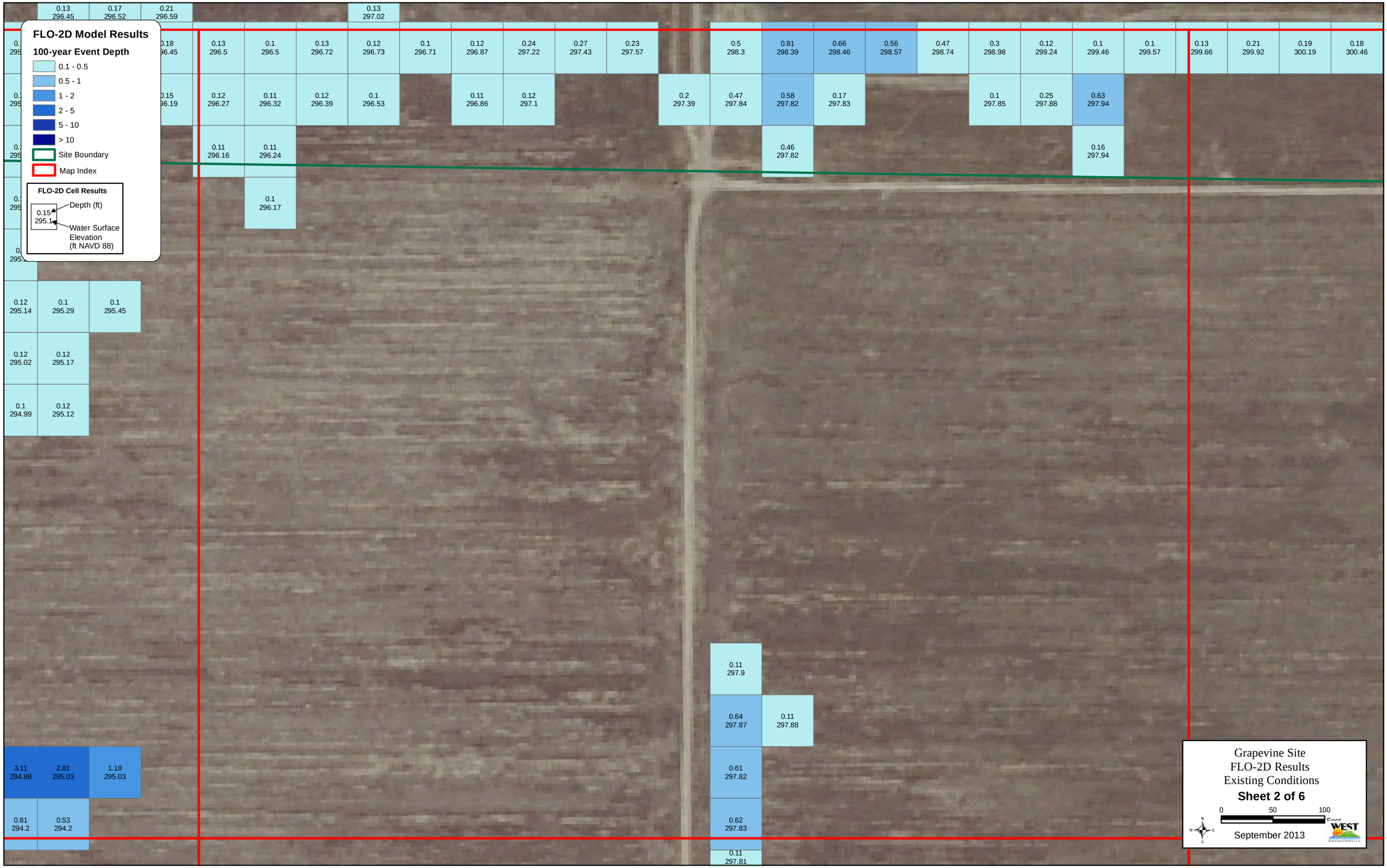
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Site Boundary
Map Index
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Depth (ft)
Water Surface Elevation (ft NAVD 88)
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Grapevine Site
FLO-2D Results
Existing Conditions
Sheet 2 of 6
0
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Feet
September 2013

FLO-2D Model Results
100-year Event Depth
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Site Boundary
Map Index
FLO-2D Cell Results
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Depth (ft)
Water Surface Elevation (ft NAVD 88)
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Grapevine Site
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Existing Conditions
Sheet 3 of 6
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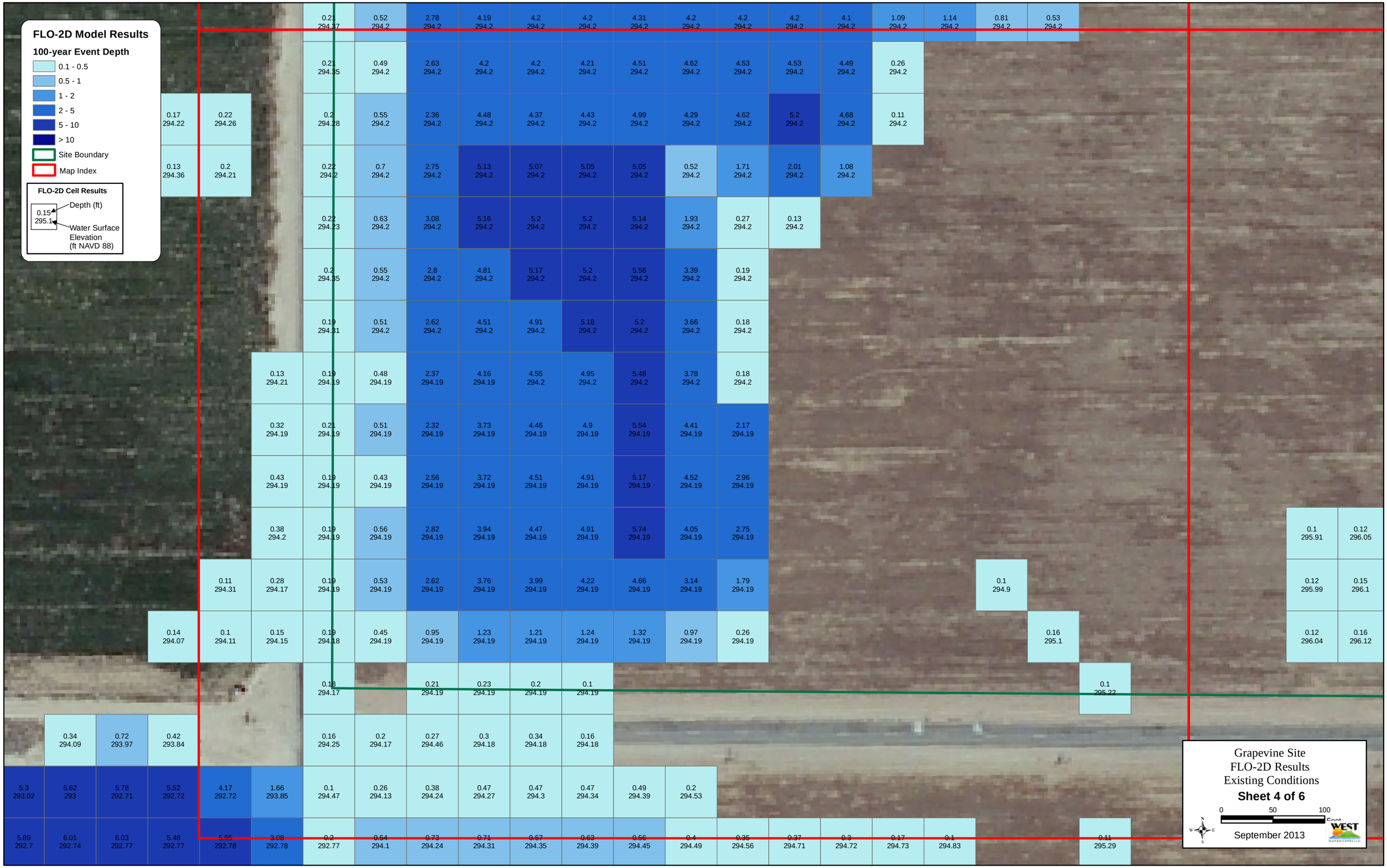
Feet
September 2013
WEST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Site Boundary
Map Index
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Depth (ft)
Water Surface Elevation (ft NAVD 88)
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0.63 294.39
0.56 294.45
0.4 294.49
0.35 294.56
0.37 294.71
0.3 294.72
0.17 294.73
0.1 294.83
0.11 295.29
Grapevine Site
FLO-2D Results
Existing Conditions
Sheet 4 of 6
0
50
100
Feet
N
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September 2013
WEST

FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.81
0.53
0.62
297.83
0.11
297.81
0.13
297.82
0.14
297.76
0.15
297.69
0.13
297.7
0.11
297.06
0.11
297.24
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297.06
0.1
297.11
0.1
297.06
0.11
297.1
0.1
295.91
0.12
296.05
0.1
294.9
0.12
295.99
0.15
296.1
0.12
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0.13
297.1
0.15
297.11
0.1
297.14
0.1
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295.1
0.12
296.04
0.16
296.12
0.19
296.15
0.12
296.19
0.2
297.03
0.52
297.09
0.14
297.11
0.16
297.13
0.13
297.17
0.1
295.22
0.15
296.16
0.15
296.19
0.11
296.24
0.1
297.03
0.1
297.1
0.11
295.29
Grapevine Site
FLO-2D Results
Existing Conditions
Sheet 5 of 6
0
50
100
Feet
September 2013
WEST

FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.18 303.07
0.73 302.02
0.55 302.02
0.73 302.02
0.88 302.04
0.87 302.02
0.55 302.02
0.79 302.02
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1.25 302.02
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0.77 302.09
0.12 302.02
0.97 302.1
1.69 302.02
1.53 302.02
0.11 300.08
0.14 300.11
0.14 300.14
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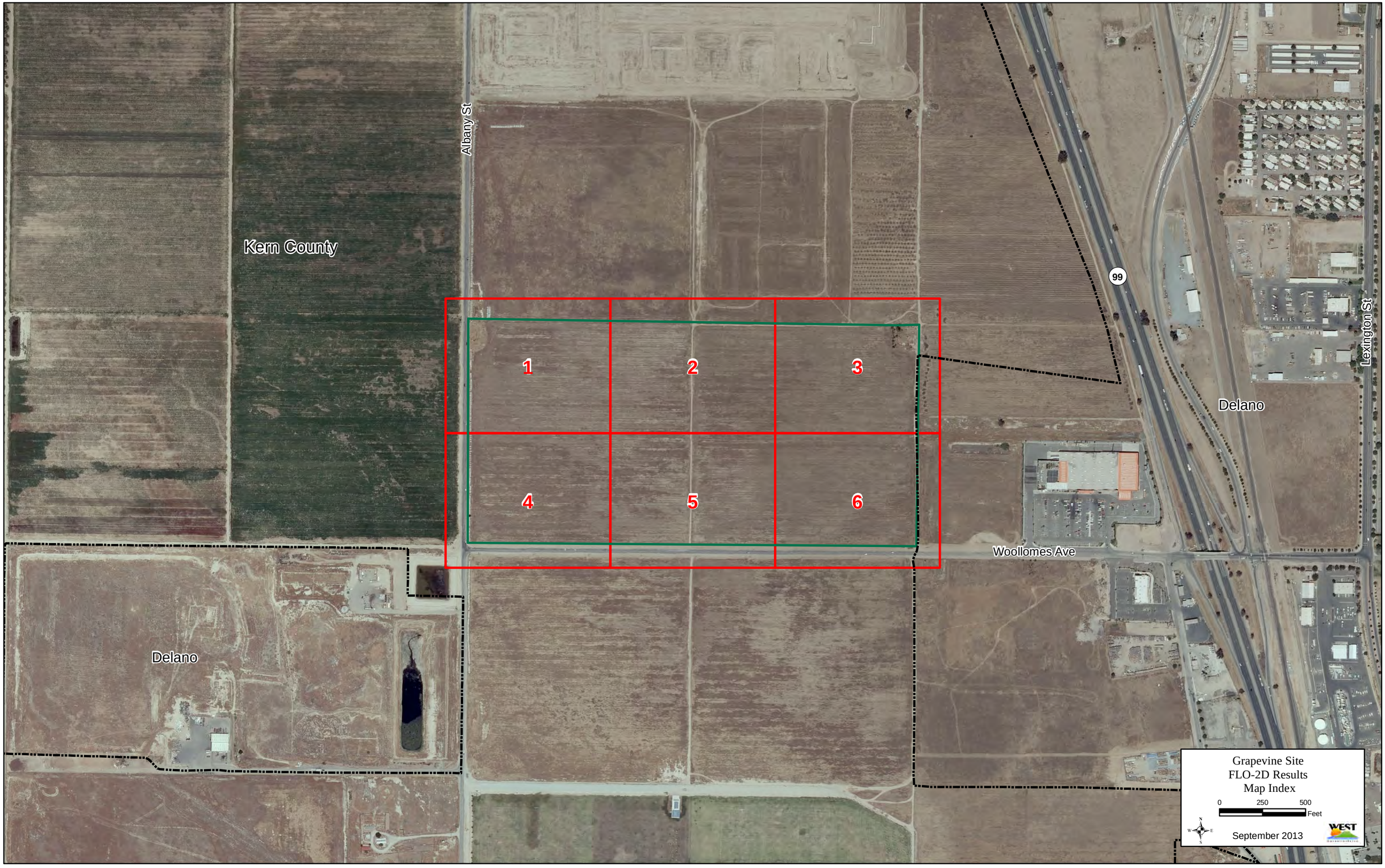
1.15 302.05
0.98 302.02
1.34 302.02
1.76 302.02
1.74 302.02
0.11 300.08
0.14 300.11
0.12 300.14
0.31 303.27
1.28 302.01
1.26 302.02
1.09 302.02
1.52 302.02
1.73 302.02
0.11 300.07
0.13 300.11
0.12 300.14
0.1 300.5
0.1 300.69
0.49 302.9
1.31 302.01
0.92 302.02
0.48 302.02
1.09 302.02
1.57 302.02
0.11 299.09
0.11 300.11
0.1 300.13
0.11 300.73
0.11 300.92
0.23 301.45
0.31 302.03
1 302.01
0.71 302.02
0.15 302.02
0.57 302.02
0.1 300.07
0.1 300.56
0.1 300.75
3.02 297.06
2.97 292.93
3.12 293.15
3.04 293.37
1.8 293.64
2.97 295.57
2.97 289.97
3.23 289.97
3.44 289.97
1.73 289.97
2.72 295.61
2.97 289.97
3.23 289.97
3.75 289.97
1.83 289.97
0.41 295.69
1.02 289.97
1.11 289.97
1.61 289.97
0.5 289.97
0.11 303.79
0.45 303.37
1.65 304.69
1.5 302.64
Grapevine Site
FLO-2D Results
Existing Conditions
Sheet 6 of 6
0
50
100
Feet
September 2013
WEST

Exhibit 2

Proposed Conditions
100-year Depth and Water Surface Elevation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Albany St
99
Lexington St
Delano
Woollomes Ave
Delano
1
2
3
4
5
6
Grapevine Site
FLO-2D Results
Map Index
0
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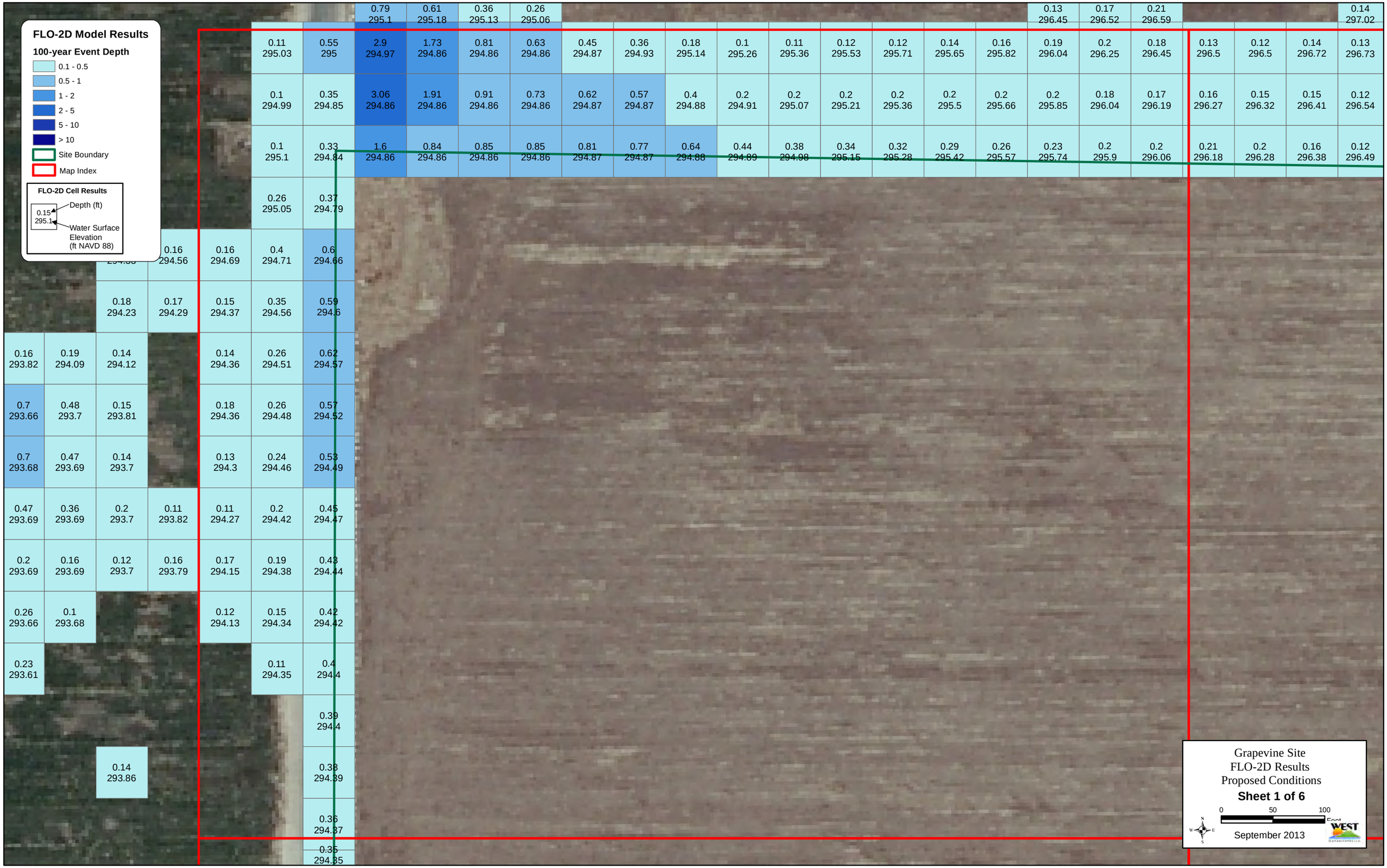
500
Feet
September 2013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100-year Event Depth
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1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.79 295.1
0.61 295.18
0.36 295.13
0.26 295.06
0.13 296.45
0.17 296.52
0.21 296.59
0.14 297.02
0.11 295.03
0.55 295
2.9 294.97
1.73 294.86
0.81 294.86
0.63 294.86
0.45 294.87
0.36 294.93
0.18 295.14
0.1 295.26
0.11 295.36
0.12 295.53
0.12 295.71
0.14 295.65
0.16 295.82
0.19 296.04
0.2 296.25
0.18 296.45
0.13 296.5
0.12 296.5
0.14 296.72
0.13 296.73
0.1 294.99
0.35 294.85
3.06 294.86
1.91 294.86
0.91 294.86
0.73 294.86
0.62 294.87
0.57 294.87
0.4 294.88
0.2 294.91
0.2 295.07
0.2 295.21
0.2 295.36
0.2 295.5
0.2 295.66
0.2 295.85
0.18 296.04
0.17 296.19
0.16 296.27
0.15 296.32
0.15 296.41
0.12 296.54
0.1 295.1
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1.6 294.86
0.84 294.86
0.85 294.86
0.85 294.86
0.81 294.87
0.77 294.87
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0.44 294.89
0.38 294.98
0.34 295.15
0.32 295.28
0.29 295.42
0.26 295.57
0.23 295.74
0.2 295.9
0.2 296.06
0.21 296.18
0.2 296.28
0.16 296.38
0.12 296.49
0.26 295.05
0.37 294.79
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0.16 294.69
0.4 294.71
0.6 294.66
0.18 294.23
0.17 294.29
0.15 294.37
0.35 294.56
0.59 294.6
0.16 293.82
0.19 294.09
0.14 294.12
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0.62 294.57
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0.26 294.48
0.57 294.52
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0.47 293.69
0.14 293.7
0.13 294.3
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0.53 294.49
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0.36 293.69
0.2 293.7
0.11 293.82
0.11 294.27
0.2 294.42
0.45 294.47
0.2 293.69
0.16 293.69
0.12 293.7
0.16 293.79
0.17 294.15
0.19 294.38
0.43 294.44
0.26 293.66
0.1 293.68
0.12 294.13
0.15 294.34
0.42 294.42
0.23 293.61
0.11 294.35
0.4 294.4
0.39 294.4
0.14 293.86
0.38 294.39
0.36 294.37
0.35 294.35
Grapevine Site
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50
100
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FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
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FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.13 296.45
0.17 296.52
0.21 296.59
0.14 297.02
0.18 296.45
0.13 296.5
0.12 296.5
0.14 296.72
0.13 296.73
0.1 296.72
0.12 296.87
0.25 297.22
0.28 297.43
0.24 297.57
0.51 298.3
0.81 298.39
0.66 298.46
0.56 298.57
0.47 298.74
0.31 298.98
0.13 299.24
0.12 299.46
0.11 299.57
0.14 299.66
0.23 299.92
0.2 300.19
0.2 300.46
0.17 296.19
0.16 296.27
0.15 296.32
0.15 296.41
0.12 296.54
0.1 296.67
0.11 296.86
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0.2 297.4
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0.58 297.83
0.17 297.83
0.11 297.85
0.26 297.89
0.64 297.95
0.2 296.06
0.21 296.18
0.2 296.28
0.16 296.38
0.12 296.49
0.11 296.65
0.46 297.83
0.17 297.95
Grapevine Site
FLO-2D Results
Proposed Conditions
Sheet 2 of 6
0
50
100
Feet
September 2013
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FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
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295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
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0.23 299.92
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0.2 300.46
0.19 300.59
0.17 300.6
0.14 300.69
0.12 300.81
0.14 300.93
0.12 301.07
0.13 301.08
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0.52 303.72
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0.11 302.71
0.16 302.76
0.12 302.77
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0.2 302.67
0.2 302.75
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0.26 302.65
0.22 302.81
0.33 302.65
0.36 302.96
0.31 302.65
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0.24 302.65
0.15 302.65
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0.14 302.99
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0.31 302.5
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0.33 302.46
0.22 302.46
0.15 302.48
0.18 302.46
0.39 302.42
0.22 302.36
0.4 302.84
0.51 303.07
0.29 303.67
0.88 302.35
0.28 302.35
1.12 302.35
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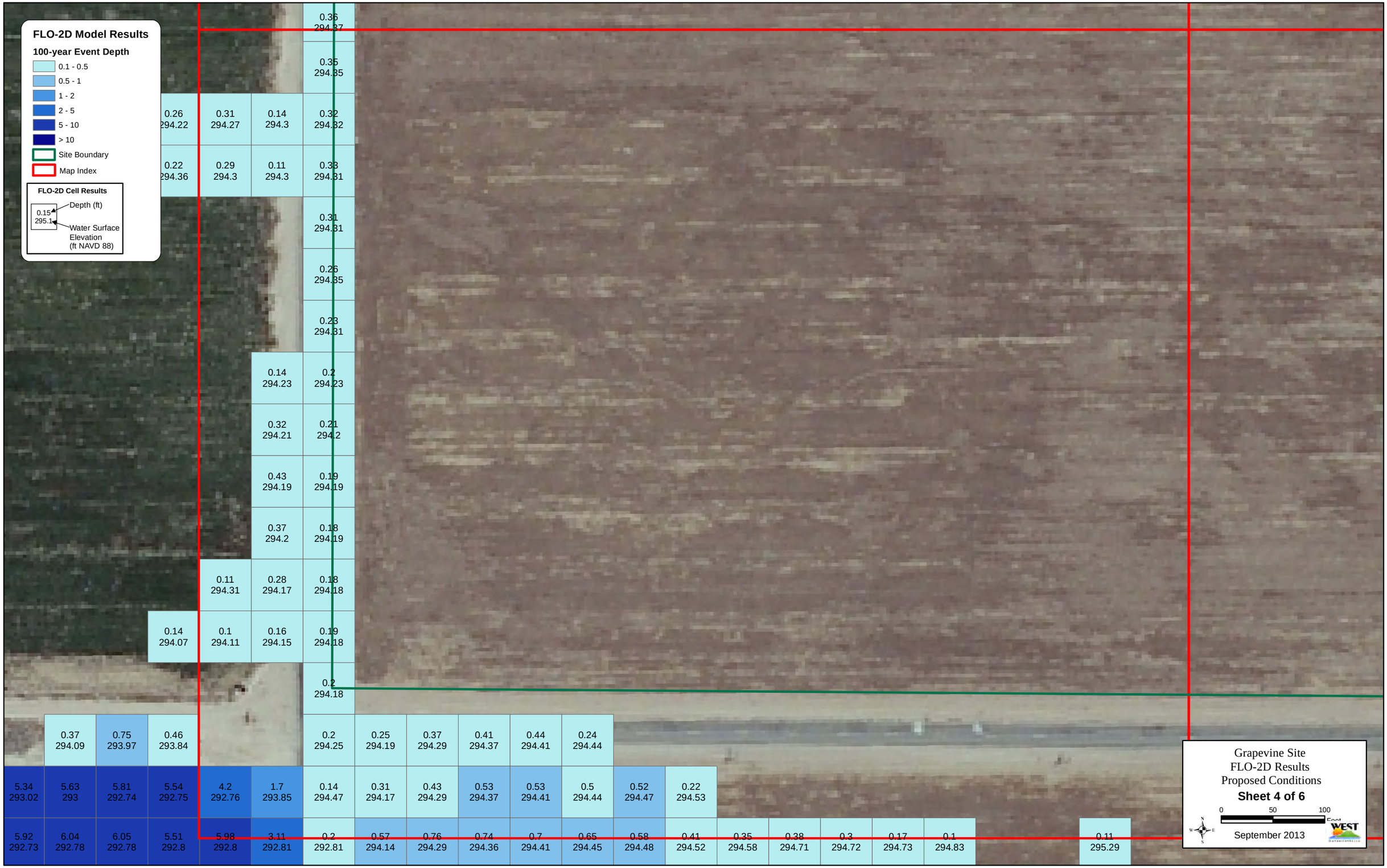
Grapevine Site
FLO-2D Results
Proposed Conditions
Sheet 3 of 6
0
50
100
Feet
September 2013
WEST


FLO-2D Model Results
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0.1 - 0.5
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2 - 5
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> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.36 294.37
0.35 294.35
0.26 294.22
0.31 294.27
0.14 294.3
0.32 294.32
0.22 294.36
0.29 294.3
0.11 294.3
0.33 294.31
0.31 294.31
0.26 294.35
0.23 294.31
0.14 294.23
0.2 294.23
0.32 294.21
0.21 294.2
0.43 294.19
0.19 294.19
0.37 294.2
0.18 294.19
0.11 294.31
0.28 294.17
0.18 294.18
0.14 294.07
0.1 294.11
0.16 294.15
0.19 294.18
0.2 294.18
0.37 294.09
0.75 293.97
0.46 293.84
0.2 294.25
0.25 294.19
0.37 294.29
0.41 294.37
0.44 294.41
0.24 294.44
5.34 293.02
5.63 293
5.81 292.74
5.54 292.75
4.2 292.76
1.7 293.85
0.14 294.47
0.31 294.17
0.43 294.29
0.53 294.37
0.53 294.41
0.5 294.44
0.52 294.47
0.22 294.53
5.92 292.73
6.04 292.78
6.05 292.78
5.51 292.8
5.98 292.8
3.11 292.81
0.2 292.81
0.57 294.14
0.76 294.29
0.74 294.36
0.7 294.41
0.65 294.45
0.58 294.48
0.41 294.52
0.35 294.58
0.38 294.71
0.3 294.72
0.17 294.73
0.1 294.83
0.11 295.29
Grapevine Site
FLO-2D Results
Proposed Conditions
Sheet 4 of 6
0
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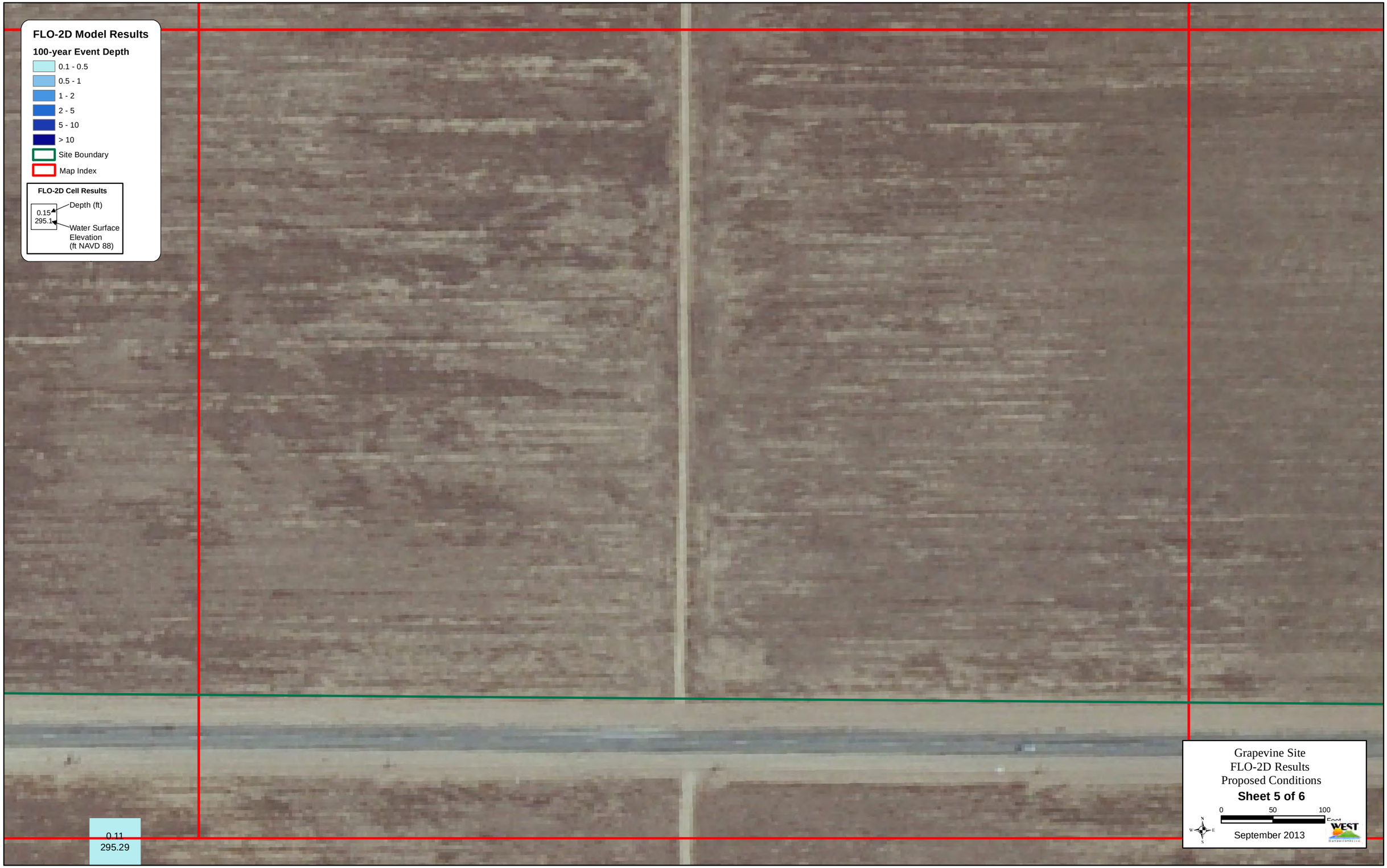
100
Feet
September 2013
WEST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1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.11
295.29
Grapevine Site
FLO-2D Results
Proposed Conditions
Sheet 5 of 6
0
50
100
Feet
September 2013
WEST

FLO-2D Model Results
100-year Event Depth
0.1 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
> 10
Site Boundary
Map Index
FLO-2D Cell Results
0.15
295.1
Depth (ft)
Water Surface Elevation (ft NAVD 88)
0.51 303.07
1.06 302.35
0.88 302.35
1.06 302.35
1.21 302.35
0.29 303.67
0.88 302.35
0.28 302.35
1.12 302.35
1.71 302.35
0.33 303.49
1.1 302.35
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1.3 302.35
2.02 302.35
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1.25 302.35
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1.42 302.35
0.63 302.34
0.64 302.34
1.34 302.35
1.04 302.35
0.32 302.35
0.48 302.35
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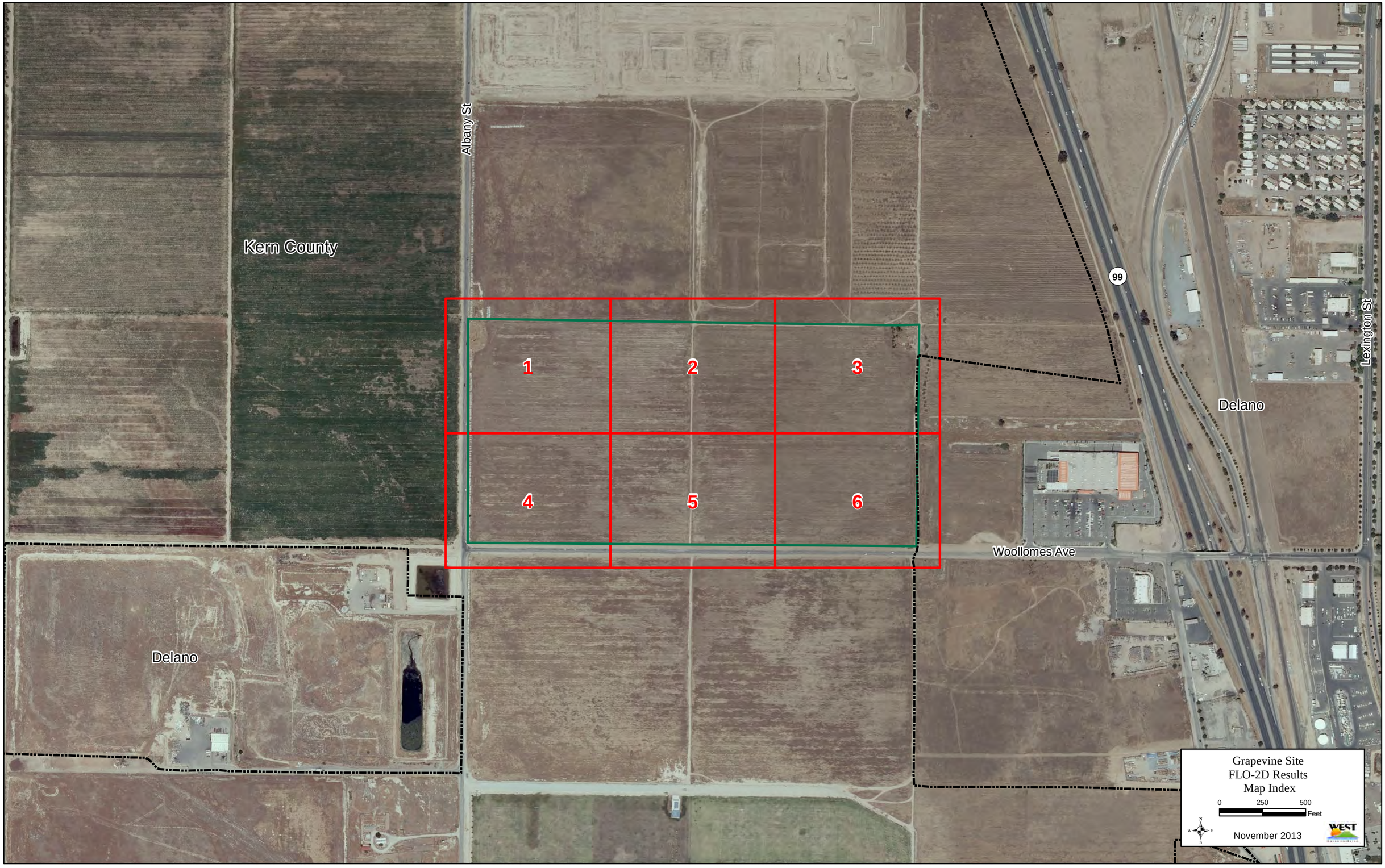
0.42 302.35
0.12 303.79
0.46 303.38
1.66 304.69
1.51 302.64
Grapevine Site
FLO-2D Results
Proposed Conditions
Sheet 6 of 6
0
50
100
Feet
September 2013
WEST

Exhibit 3

Proposed Minus Existing Conditions
100-year Depth


Kern County
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Delano
Lexington St
Woollomes Ave
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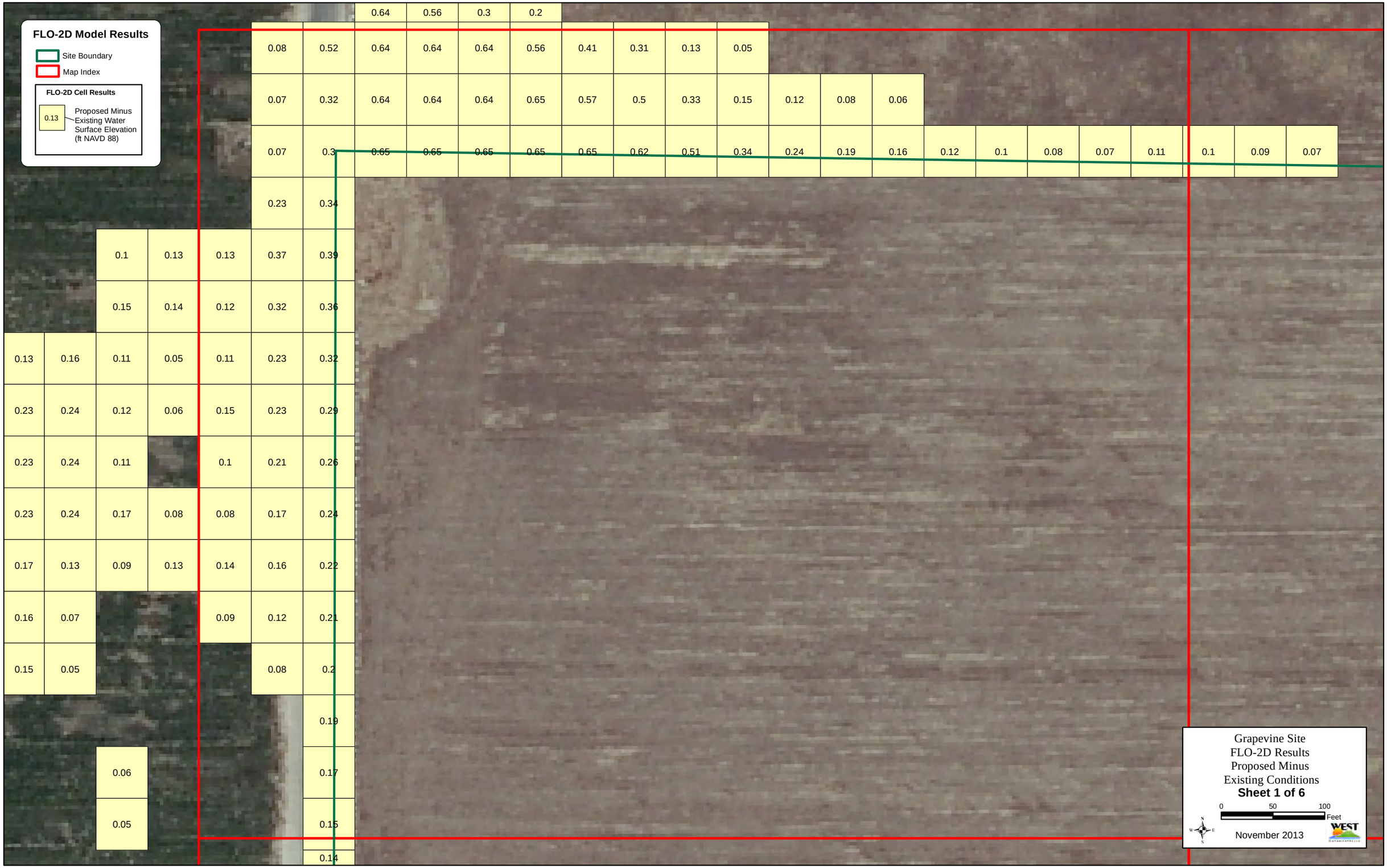
6
Grapevine Site
FLO-2D Results
Map Index
0
250
500
Feet
November 2013
WEST


FLO-2D Model Results
Site Boundary
Map Index
FLO-2D Cell Results
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0.07 0.32 0.64 0.64 0.64 0.65 0.57 0.5 0.33 0.15 0.12 0.08 0.06
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0.23 0.34
0.1 0.13 0.13 0.37 0.39
0.15 0.14 0.12 0.32 0.36
0.13 0.16 0.11 0.05 0.11 0.23 0.32
0.23 0.24 0.12 0.06 0.15 0.23 0.29
0.23 0.24 0.11 0.1 0.21 0.26
0.23 0.24 0.17 0.08 0.08 0.17 0.24
0.17 0.13 0.09 0.13 0.14 0.16 0.22
0.16 0.07 0.09 0.12 0.21
0.15 0.05 0.08 0.2
0.19
0.06
0.17
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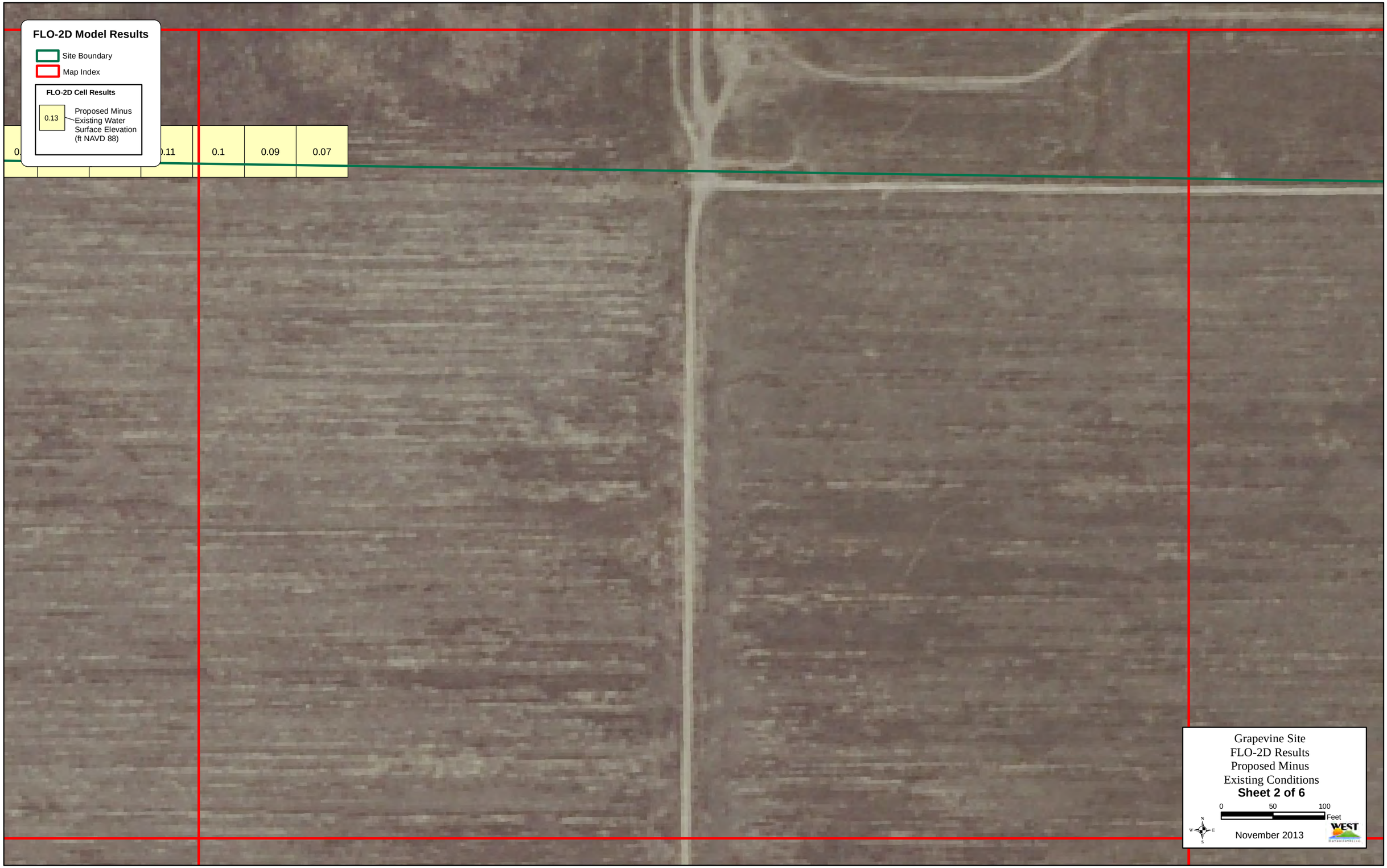
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 1 of 6
0 50 100
Feet
November 2013
WEST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Site Boundary
Map Index
FLO-2D Cell Results
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Proposed Minus Existing Water Surface Elevation (ft NAVD 88)
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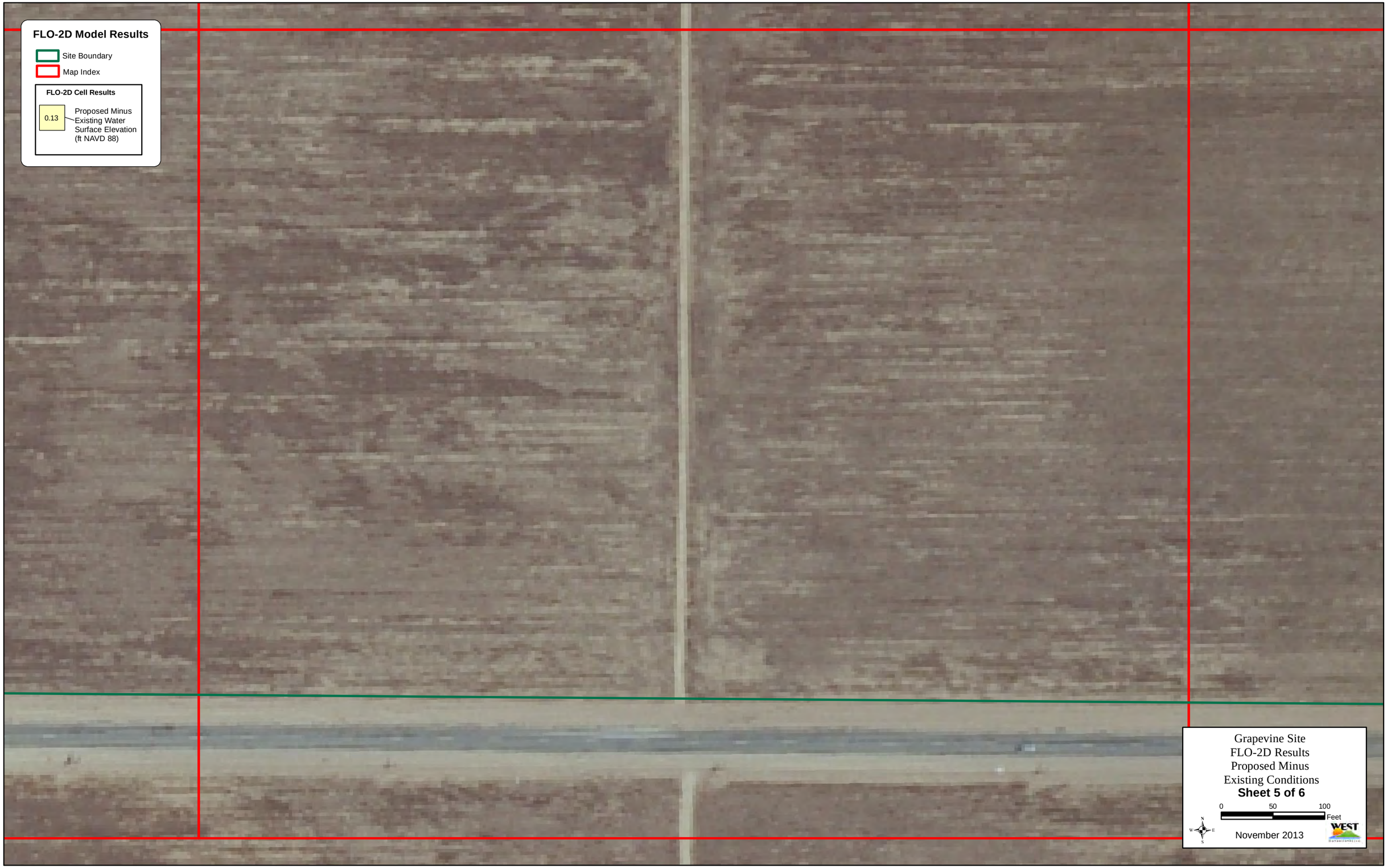
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 2 of 6
0
50
100
Feet
November 2013

FLO-2D Model Results
Site Boundary
Map Index
FLO-2D Cell Results
0.13
Proposed Minus Existing Water Surface Elevation (ft NAVD 88)
0.05
0.07
0.21
0.07
0.23
0.14
0.08
0.1
0.33
0.19
0.33
0.33
0.33
0.33
0.26
0.33
0.25
0.33
0.33
0.33
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 3 of 6
0
50
100
Feet
November 2013
WEST

FLO-2D Model Results
Site Boundary
Map Index
FLO-2D Cell Results
0.13
Proposed Minus Existing Water Surface Elevation (ft NAVD 88)
0.15
0.14
0.09
0.09
0.11
0.12
0.09
0.09
0.08
0.11
0.09
0.06
0.05
0.1
0.11
0.1
0.08
0.05
0.05
0.06
0.06
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 4 of 6
0
50
100
Feet
November 2013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Site Boundary
Map Index
FLO-2D Cell Results
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Proposed Minus Existing Water Surface Elevation (ft NAVD 88)
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 5 of 6
0
50
100
Feet
November 2013
WEST

FLO-2D Model Results
Site Boundary
Map Index
FLO-2D Cell Results
0.13
Proposed Minus Existing Water Surface Elevation (ft NAVD 88)
0.33 0.33 0.33 0.33 0.33 0.33
0.26 0.33 0.25 0.33 0.33 0.33
0.3 0.33 0.33 0.33 0.33 0.33
0.34 0.33 0.33 0.33 0.33 0.33
0.34 0.33 0.33 0.33 0.33 0.33
0.31 0.34 0.33 0.33 0.33 0.33 0.33
0.4 0.33 0.34 0.33 0.29 0.33 0.33
0.44 0.14 0.34
Grapevine Site
FLO-2D Results
Proposed Minus
Existing Conditions
Sheet 6 of 6
0 50 100
Feet
November 2013

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HYDROLOGY STUDY
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Civil Engineering
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Storm Water Quality SWPPP
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Site Development, Planning And Surveying
Construction Staking Services
Redevelopment Area Enhancement Engineering
Traffic Engineering
Transportation Planning

APN 521-010-19, 521-010-20, 521-010-21
Section 14, Township 25 South, Range 25 East
City of Delano, California

July 12, 2013
REVISED: October 31, 2013

Prepared By: Richard L. Baker, E.I.T.

7/24/13
Derrill Whitten, PE
RCE# 51930

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DERRILL G. WHITTEN, JR.
No. C-051930
Exp. _____
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Oceanside, CA 92054-2801
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CONCLUSION 2
CALCULATIONS 3
(Runoff Volume, Peak Flow Calculations, and Sump Sizing)

ATTACHMENTS:

Rainfall Intensity Curves 5
Figure 1. - Site Plan
Exhibit "A" – Preliminary Hydrology (24x36 sheet)

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PROJECT DESCRIPTION

The project applicant submitted to the City an application for an approximately 328,500-square-foot shopping center. The proposed project would include a 12-screen theater; a lifestyle component to include retail shops and restaurants (sit-down and fast-food); midsize retailers between 10,000 to 25,000 square feet and outparcels for fast food; and drive through and sit down restaurants, with proposed building sizes ranging from 2,500 to 10,000 square feet. The site plan for the proposed project is shown in **Figure 1**, **Site Plan**. The height of the majority of the buildings at the project site would fall between 20 and 40 feet with some buildings reaching a height of 50 feet for an architectural feature. Illuminated signs of up to 80 feet in height will also be used to publicize the proposed shopping center.

PURPOSE

The purpose of this study is to describe a general drainage plan for stormwater runoff of the site and determine preliminary design parameters for the on-site storm water collection system. This report is limited to the on-site collection system.

EXISTING CONDITIONS

Delano Grapevine currently is undeveloped with little vegetation and flat if any slopes. Existing storm sewer in the area consists of runoff from development to the east by means of a 60" ø reinforced concrete pipe (RCP) in Woollomes Avenue. Runoff is thence conveyed to a retention basin in the southeast corner of the Delano Grapevine site.

The FEMA flood zoning maps designate the site to be 75% coverage within Zone 'A' an area subject to flooding. The site can be found on FEMA flood map panel 06029C0725E. The scope of this study is to provide a preliminary hydrology analysis. Flood hazard analysis is outside the scope of this report and is to be completed by others.

METHODOLOGY

Onsite stormwater volume and peak flow were calculated using the Rational Method in accordance with the Kern County Hydrology Manual [Hromadka; Section D[1]]. The 10 year storm frequency was used to calculate the peak flow generated by developing the site. Civild software by Joseph E. Bonadiman and Associates was utilized in performing the analysis. The software is the only application approved for this use by the County of Kern.

The initial area Tc was calculated by the software with data input specific to the initial areas. For subsequent sub-areas, the time of concentration, T_C, was determined from the

[1]Hromadka, T.V. County of Kern. Department of Planning and Development Services. Kern County Hydrology Manual. 1993. Print.

distance traveled and the change in elevation experienced across the sub-area. Each Tc was then used with the intensity curves to obtain an intensity, I. The runoff coefficient for the site was assigned by the software based upon a general commercial land use.

Runoff generated at any location of new development is required by Kern County to be detained. The adequate sizing of a sump capable of detaining the runoff was calculated by employing Kern County Sump Volume Requirements [Lackey[2]]. This method sizes a sump based off of Intermediate Storm Design Discharge (ISDD) 5-day rainfall event, impervious area, and total area. These values result in the volume necessary to retain runoff, not including one foot above the high water mark of freeboard.

PROPOSED DRAINAGE PLAN

Proposed site improvements do not incorporate the use of the existing retention basin. The existing runoff is to be redirected to a retention basin to the west by means of extending the 60" ø R.C.P. along Woollomes Ave.

Delano Grapevine runoff will be collected and carried offsite by means of 4 lateral mains. Location of these mains will be along Dover Parkway, Belmont Street, and two main thoroughfares of the proposed development. Preliminary locations of stormwater collection structures, and preliminary sizing can be observed in **Exhibit "A"- Preliminary Hydrology**. Runoff will then be conveyed to the 60" ø R.C.P. extended along Woollomes Avenue, and thence to a retention basin.

CONCLUSION

Stormwater from the development of the site shall be discharged to the City Collection system off-site. All pipes on the site will convey a 10 year 24-hour precipitation event without allowing the hydraulic grade line to get within a foot of the finished pad elevations.

[2] Lackey, Charles. County of Kern. Engineering, Surveying, & Permit Services Department. Engineering Bulletin 11-02. 2011. Print. <http://www.co.kern.ca.us/bid/pdfs/bulletin11-02finald3-sumpvolumerequirements.pdf>.

Calculations

Kern County Rational Hydrology Program

(Hydrology Manual Dated 1992)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 2006 Version 7.2
Rational Hydrology Study Date: 07/15/13 File: 390gpv.out

390-04 GRAPEVINE
RLB 20130711

Program License Serial Number 6027

********* Hydrology Study Control Information **********

ENGLISH UNITS USED FOR RAINFALL DATA

Rainfall map data:

Year Storm	Hour	Rainfall
2	6	0.745(In.)
2	24	1.100(In.)
100	6	1.650(In.)
100	24	2.500(In.)

Latitude in degrees = 35.75
SAN JOAQUIN VALLEY area of study
Y2 = 0.342, Y100 = 0.696 or Y100 = 0.697
Note: Larger value of Y100 = 0.697 used
Slope used for rainfall intensity curve b = 0.6500

Remaining year storm values:

1 Hour Rainfall -	Year Storm
0.342	2
0.430	5
0.488	10
0.563	25
0.632	50
0.697	100

24 Hour Rainfall -	Year Storm
1.100	2
1.446	5
1.675	10
1.973	25
2.244	50
2.500	100

Note: Computer estimated pipe sizes use 10 year storm flow rates
NOTE: ENGLISH (IN-LB) INPUT DATA UNITS USED
NOTE: ENGLISH (IN-LB) OUTPUT DATA UNITS USED

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Process from Point 1.000 to Point 2.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 400.000(Ft.)
Top (of initial area) elevation = 293.590(Ft.)
Bottom (of initial area) elevation = 292.790(Ft.)
Difference in elevation = 0.800(Ft.)
Slope = 0.00200 s(%)= 0.20
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.574 min.
Rainfall intensity = 2.032(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 4.701(CFS)
Subarea runoff = 5.456(CFS)
Total initial stream area = 3.040(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	3.0	11.57	1.25	0.04	0.83	2.8	3.3	3.3
10	3.0	11.57	1.42	0.04	0.83	3.2	3.8	3.8
25	3.0	11.57	1.64	0.04	0.84	3.8	4.4	4.4
50	3.0	11.57	1.84	0.04	0.84	4.2	4.9	4.9

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Process from Point        2.000 to Point        3.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   291.79(Ft.)
Downstream point elevation =   290.69(Ft.)
Pipe Slope = 0.0022 Ft/Ft
Pipe length  =   500.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.456(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     5.456(CFS)
Normal flow depth in pipe =   12.20(In.)
Flow top width inside pipe =   24.00(In.)
Critical Depth =    9.88(In.)
Pipe flow velocity =      3.40(Ft/s)
Travel time through pipe =    2.45 min.
Time of concentration (TC) =    14.02 min.
-------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     3.321(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     3.321(CFS)
Normal flow depth in pipe =    9.22(In.)
Flow top width inside pipe =   23.35(In.)
Critical Depth =    7.63(In.)
Pipe flow velocity =      2.99(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     3.785(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     3.785(CFS)
Normal flow depth in pipe =    9.90(In.)
Flow top width inside pipe =   23.63(In.)
Critical Depth =    8.18(In.)
Pipe flow velocity =      3.09(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     4.388(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.388(CFS)
Normal flow depth in pipe =   10.76(In.)
Flow top width inside pipe =   23.87(In.)
Critical Depth =    8.83(In.)
Pipe flow velocity =      3.22(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     4.938(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.938(CFS)
Normal flow depth in pipe =   11.51(In.)
Flow top width inside pipe =   23.98(In.)
Critical Depth =    9.39(In.)
Pipe flow velocity =      3.32(Ft/s)
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Process from Point 2.000 to Point 3.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 6.251(CFS)
Time of concentration = 14.02 min.
Rainfall intensity = 1.794(In/Hr) for a 100 year storm
Subarea runoff = 1.781(CFS) for 1.540(Ac.)
Total runoff = 7.237(CFS) Total area = 4.58(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	4.6	16.83	0.98	0.04	0.83	3.3	3.9	3.9
10	4.6	15.99	1.15	0.04	0.83	4.0	4.6	4.6
25	4.6	15.01	1.39	0.04	0.84	4.8	5.6	5.6
50	4.6	14.45	1.60	0.04	0.84	5.5	6.4	6.4

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Process from Point        3.000 to Point        4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   290.69(Ft.)
Downstream point elevation =   290.41(Ft.)
Pipe Slope = 0.0015 Ft/Ft
Pipe length  =   185.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.237(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     7.237(CFS)
Normal flow depth in pipe =   16.57(In.)
Flow top width inside pipe =   22.19(In.)
Critical Depth =   11.46(In.)
Pipe flow velocity =      3.13(Ft/s)
Travel time through pipe =    0.99 min.
Time of concentration (TC) =    15.01 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     3.889(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     3.889(CFS)
Normal flow depth in pipe =   11.17(In.)
Flow top width inside pipe =   23.94(In.)
Critical Depth =    8.29(In.)
Pipe flow velocity =      2.71(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     4.592(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.592(CFS)
Normal flow depth in pipe =   12.30(In.)
Flow top width inside pipe =   23.99(In.)
Critical Depth =    9.04(In.)
Pipe flow velocity =      2.83(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     5.560(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     5.560(CFS)
Normal flow depth in pipe =   13.84(In.)
Flow top width inside pipe =   23.72(In.)
Critical Depth =    9.99(In.)
Pipe flow velocity =      2.96(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     6.421(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     6.421(CFS)
Normal flow depth in pipe =   15.21(In.)
Flow top width inside pipe =   23.12(In.)
Critical Depth =   10.76(In.)
Pipe flow velocity =      3.06(Ft/s)
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Process from Point 3.000 to Point 4.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 8.032(CFS)
Time of concentration = 15.01 min.
Rainfall intensity = 1.716(In/Hr) for a 100 year storm
Subarea runoff = 2.052(CFS) for 1.570(Ac.)
Total runoff = 9.289(CFS) Total area = 6.15(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	6.2	18.01	0.94	0.04	0.83	4.3	5.0	5.0
10	6.2	17.11	1.10	0.04	0.83	5.1	5.9	5.9
25	6.2	16.06	1.33	0.04	0.84	6.2	7.1	7.1
50	6.2	15.46	1.53	0.04	0.84	7.1	8.2	8.2

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Process from Point        4.000 to Point        5.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   290.41(Ft.)
Downstream point elevation =   290.21(Ft.)
Pipe Slope = 0.0010 Ft/Ft
Pipe length  =   202.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.289(CFS)
Given pipe size =     27.00(In.)
Calculated individual pipe flow  =     9.289(CFS)
Normal flow depth in pipe =   21.07(In.)
Flow top width inside pipe =   22.36(In.)
Critical Depth =   12.59(In.)
Pipe flow velocity =      2.79(Ft/s)
Travel time through pipe =    1.21 min.
Time of concentration (TC) =    16.22 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     4.987(CFS)
Given pipe size =     27.00(In.)
Calculated individual pipe flow  =     4.987(CFS)
Normal flow depth in pipe =   13.69(In.)
Flow top width inside pipe =   27.00(In.)
Critical Depth =    9.11(In.)
Pipe flow velocity =      2.47(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     5.891(CFS)
Given pipe size =     27.00(In.)
Calculated individual pipe flow  =     5.891(CFS)
Normal flow depth in pipe =   15.14(In.)
Flow top width inside pipe =   26.80(In.)
Critical Depth =    9.94(In.)
Pipe flow velocity =      2.57(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     7.135(CFS)
Given pipe size =     27.00(In.)
Calculated individual pipe flow  =     7.135(CFS)
Normal flow depth in pipe =   17.16(In.)
Flow top width inside pipe =   25.99(In.)
Critical Depth =   10.97(In.)
Pipe flow velocity =      2.68(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     8.240(CFS)
Given pipe size =     27.00(In.)
Calculated individual pipe flow  =     8.240(CFS)
Normal flow depth in pipe =   19.03(In.)
Flow top width inside pipe =   24.63(In.)
Critical Depth =   11.83(In.)
Pipe flow velocity =      2.75(Ft/s)
----------------------------------------------------------------------
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Process from Point 4.000 to Point 5.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 10.544(CFS)
Time of concentration = 16.22 min.
Rainfall intensity = 1.632(In/Hr) for a 100 year storm
Subarea runoff = 2.891(CFS) for 2.340(Ac.)
Total runoff = 12.180(CFS) Total area = 8.49(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	8.5	19.46	0.89	0.04	0.83	5.6	6.5	6.5
10	8.5	18.49	1.05	0.04	0.83	6.7	7.7	7.7
25	8.5	17.35	1.26	0.04	0.84	8.1	9.4	9.4
50	8.5	16.70	1.45	0.04	0.84	9.3	10.8	10.8

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Process from Point        5.000 to Point        6.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   290.21(Ft.)
Downstream point elevation =   289.65(Ft.)
Pipe Slope = 0.0015 Ft/Ft
Pipe length  =   377.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.180(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    12.180(CFS)
Normal flow depth in pipe =   19.76(In.)
Flow top width inside pipe =   28.45(In.)
Critical Depth =   14.04(In.)
Pipe flow velocity =      3.55(Ft/s)
Travel time through pipe =    1.77 min.
Time of concentration (TC) =    17.99 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     6.533(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     6.533(CFS)
Normal flow depth in pipe =   13.44(In.)
Flow top width inside pipe =   29.84(In.)
Critical Depth =   10.15(In.)
Pipe flow velocity =      3.07(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     7.720(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     7.720(CFS)
Normal flow depth in pipe =   14.79(In.)
Flow top width inside pipe =   30.00(In.)
Critical Depth =   11.06(In.)
Pipe flow velocity =      3.20(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     9.352(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     9.352(CFS)
Normal flow depth in pipe =   16.59(In.)
Flow top width inside pipe =   29.83(In.)
Critical Depth =   12.23(In.)
Pipe flow velocity =      3.35(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    10.804(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    10.804(CFS)
Normal flow depth in pipe =   18.21(In.)
Flow top width inside pipe =   29.30(In.)
Critical Depth =   13.20(In.)
Pipe flow velocity =      3.47(Ft/s)
----------------------------------------------------------------------
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Process from Point 5.000 to Point 6.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 10.810(CFS)
Time of concentration = 17.99 min.
Rainfall intensity = 1.526(In/Hr) for a 100 year storm
Subarea runoff = 0.287(CFS) for 0.820(Ac.)
Total runoff = 12.467(CFS) Total area = 9.31(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	9.3	21.58	0.83	0.04	0.83	5.8	6.7	6.7
10	9.3	20.50	0.98	0.04	0.83	6.8	7.9	7.9
25	9.3	19.24	1.18	0.04	0.84	8.3	9.6	9.6
50	9.3	18.53	1.36	0.04	0.84	9.6	11.1	11.1

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Process from Point        6.000 to Point        7.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   289.65(Ft.)
Downstream point elevation =   287.70(Ft.)
Pipe Slope = 0.0055 Ft/Ft
Pipe length  =   354.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.467(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    12.467(CFS)
Normal flow depth in pipe =   13.37(In.)
Flow top width inside pipe =   29.82(In.)
Critical Depth =   14.23(In.)
Pipe flow velocity =      5.89(Ft/s)
Travel time through pipe =    1.00 min.
Time of concentration (TC) =    18.99 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     6.678(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     6.678(CFS)
Normal flow depth in pipe =    9.54(In.)
Flow top width inside pipe =   27.95(In.)
Critical Depth =   10.27(In.)
Pipe flow velocity =      4.97(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     7.894(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     7.894(CFS)
Normal flow depth in pipe =   10.42(In.)
Flow top width inside pipe =   28.57(In.)
Critical Depth =   11.20(In.)
Pipe flow velocity =      5.21(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     9.568(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     9.568(CFS)
Normal flow depth in pipe =   11.55(In.)
Flow top width inside pipe =   29.20(In.)
Critical Depth =   12.38(In.)
Pipe flow velocity =      5.49(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    11.056(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    11.056(CFS)
Normal flow depth in pipe =   12.50(In.)
Flow top width inside pipe =   29.58(In.)
Critical Depth =   13.36(In.)
Pipe flow velocity =      5.71(Ft/s)
----------------------------------------------------------------------
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Process from Point 6.000 to Point 7.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 13.553(CFS)
Time of concentration = 18.99 min.
Rainfall intensity = 1.473(In/Hr) for a 100 year storm
Subarea runoff = 3.148(CFS) for 2.780(Ac.)
Total runoff = 15.615(CFS) Total area = 12.09(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	12.1	22.78	0.81	0.04	0.83	7.3	8.4	8.4
10	12.1	21.65	0.95	0.04	0.83	8.6	9.9	9.9
25	12.1	20.32	1.14	0.04	0.84	10.4	12.0	12.0
50	12.1	19.56	1.31	0.04	0.84	12.0	13.8	13.8

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point        7.000 to Point        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   287.70(Ft.)
Downstream point elevation =   286.98(Ft.)
Pipe Slope = 0.0021 Ft/Ft
Pipe length  =   350.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.615(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    15.615(CFS)
Normal flow depth in pipe =   21.05(In.)
Flow top width inside pipe =   27.45(In.)
Critical Depth =   16.01(In.)
Pipe flow velocity =      4.25(Ft/s)
Travel time through pipe =    1.37 min.
Time of concentration (TC) =    20.36 min.
-----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     8.357(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     8.357(CFS)
Normal flow depth in pipe =   14.10(In.)
Flow top width inside pipe =   29.95(In.)
Critical Depth =   11.53(In.)
Pipe flow velocity =      3.69(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     9.882(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     9.882(CFS)
Normal flow depth in pipe =   15.55(In.)
Flow top width inside pipe =   29.98(In.)
Critical Depth =   12.59(In.)
Pipe flow velocity =      3.85(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    11.980(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    11.980(CFS)
Normal flow depth in pipe =   17.51(In.)
Flow top width inside pipe =   29.58(In.)
Critical Depth =   13.93(In.)
Pipe flow velocity =      4.03(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    13.846(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    13.846(CFS)
Normal flow depth in pipe =   19.29(In.)
Flow top width inside pipe =   28.75(In.)
Critical Depth =   15.02(In.)
Pipe flow velocity =      4.15(Ft/s)
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Process from Point        7.000 to Point        8.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II  = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) =     0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) =     0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) =  17.289(CFS)
Time of concentration =    20.36 min.
Rainfall intensity =      1.408(In/Hr) for a 100 year storm
Subarea runoff =      4.281(CFS) for    4.050(Ac.)
Total runoff =     19.895(CFS)    Total area =       16.14(Ac.)
----------------------------------------------------------------
               *******  DATA FOR OTHER YEAR STORMS *******
  Year  Area    TC    Intensity  Fm Avg  Y Avg   Qmin  Qcalc Qtot
        (Ac)    (Min)  (In/Hr)   (In/Hr) (In/Hr) (cfs) (cfs) (cfs)
   5   16.1   24.43     0.77      0.04   0.83     9.3  10.6  10.6
  10   16.1   23.21     0.90      0.04   0.83    10.9  12.6  12.6
  25   16.1   21.79     1.09      0.04   0.84    13.2  15.3  15.3
  50   16.1   20.97     1.25      0.04   0.84    15.3  17.6  17.6
----------------------------------------------------------------
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Process from Point        8.000 to Point        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   286.98(Ft.)
Downstream point elevation =   286.48(Ft.)
Pipe Slope = 0.0020 Ft/Ft
Pipe length  =   250.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.895(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.471(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.588(Ft.)
 Minor friction loss =      0.383(Ft.)  K-factor =   1.50
Pipe flow velocity =      4.05(Ft/s)
Travel time through pipe =    1.03 min.
Time of concentration (TC) =    21.39 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    10.637(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    10.637(CFS)
Normal flow depth in pipe =   16.41(In.)
Flow top width inside pipe =   29.87(In.)
Critical Depth =   13.10(In.)
Pipe flow velocity =      3.88(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    12.582(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    12.582(CFS)
Normal flow depth in pipe =   18.26(In.)
Flow top width inside pipe =   29.28(In.)
Critical Depth =   14.27(In.)
Pipe flow velocity =      4.03(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    15.259(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    15.259(CFS)
Normal flow depth in pipe =   20.91(In.)
Flow top width inside pipe =   27.58(In.)
Critical Depth =   15.82(In.)
Pipe flow velocity =      4.18(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    17.639(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    17.639(CFS)
Normal flow depth in pipe =   23.63(In.)
Flow top width inside pipe =   24.54(In.)
Critical Depth =   17.04(In.)
Pipe flow velocity =      4.26(Ft/s)
----------------------------------------------------------------
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Process from Point 8.000 to Point 9.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 22.565(CFS)
Time of concentration = 21.39 min.
Rainfall intensity = 1.363(In/Hr) for a 100 year storm
Subarea runoff = 6.047(CFS) for 5.610(Ac.)
Total runoff = 25.943(CFS) Total area = 21.75(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	21.8	25.67	0.75	0.04	0.83	12.1	13.9	13.9
10	21.8	24.38	0.88	0.04	0.83	14.3	16.4	16.4
25	21.8	22.89	1.05	0.04	0.84	17.3	19.9	19.9
50	21.8	22.03	1.21	0.04	0.84	20.0	23.0	23.0

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Process from Point        9.000 to Point       10.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   286.48(Ft.)
Downstream point elevation =   285.25(Ft.)
Pipe Slope = 0.0034 Ft/Ft
Pipe length  =   367.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.943(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    25.943(CFS)
Normal flow depth in pipe =   21.61(In.)
Flow top width inside pipe =   35.27(In.)
Critical Depth =   19.72(In.)
Pipe flow velocity =      5.86(Ft/s)
Travel time through pipe =    1.04 min.
Time of concentration (TC) =    22.43 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    13.859(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    13.859(CFS)
Normal flow depth in pipe =   14.91(In.)
Flow top width inside pipe =   35.46(In.)
Critical Depth =   14.20(In.)
Pipe flow velocity =      5.01(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    16.398(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    16.398(CFS)
Normal flow depth in pipe =   16.38(In.)
Flow top width inside pipe =   35.85(In.)
Critical Depth =   15.52(In.)
Pipe flow velocity =      5.24(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    19.892(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    19.892(CFS)
Normal flow depth in pipe =   18.33(In.)
Flow top width inside pipe =   35.99(In.)
Critical Depth =   17.18(In.)
Pipe flow velocity =      5.50(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    22.998(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    22.998(CFS)
Normal flow depth in pipe =   20.02(In.)
Flow top width inside pipe =   35.77(In.)
Critical Depth =   18.53(In.)
Pipe flow velocity =      5.70(Ft/s)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point        9.000 to Point       10.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     21.750(Ac.)
Runoff from this stream =     25.943(CFS)
Time of concentration =   22.43 min.
Rainfall intensity =     1.322(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

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Process from Point 11.000 to Point 12.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 370.000(Ft.)
Top (of initial area) elevation = 293.740(Ft.)
Bottom (of initial area) elevation = 293.380(Ft.)
Difference in elevation = 0.360(Ft.)
Slope = 0.00097 s(%)= 0.10
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.958 min.
Rainfall intensity = 1.888(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 7.127(CFS)
Subarea runoff = 8.260(CFS)
Total initial stream area = 4.960(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	5.0	12.96	1.16	0.04	0.83	4.3	5.0	5.0
10	5.0	12.96	1.32	0.04	0.83	4.9	5.7	5.7
25	5.0	12.96	1.53	0.04	0.84	5.7	6.6	6.6
50	5.0	12.96	1.71	0.04	0.84	6.4	7.5	7.5

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       12.000 to Point       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   293.38(Ft.)
Downstream point elevation =   292.54(Ft.)
Pipe Slope = 0.0052 Ft/Ft
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.260(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.793(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.989(Ft.)
 Minor friction loss =      0.645(Ft.)  K-factor =   1.90
Pipe flow velocity =      4.67(Ft/s)
Travel time through pipe =    0.57 min.
Time of concentration (TC) =    13.53 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     5.023(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.023(CFS)
Normal flow depth in pipe =   10.68(In.)
Flow top width inside pipe =   17.69(In.)
Critical Depth =   10.35(In.)
Pipe flow velocity =      4.60(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     5.726(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.726(CFS)
Normal flow depth in pipe =   11.65(In.)
Flow top width inside pipe =   17.20(In.)
Critical Depth =   11.08(In.)
Pipe flow velocity =      4.73(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     6.641(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.641(CFS)
Normal flow depth in pipe =   13.01(In.)
Flow top width inside pipe =   16.12(In.)
Critical Depth =   11.97(In.)
Pipe flow velocity =      4.85(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     7.475(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     7.475(CFS)
Normal flow depth in pipe =   14.48(In.)
Flow top width inside pipe =   14.27(In.)
Critical Depth =   12.70(In.)
Pipe flow velocity =      4.91(Ft/s)
----------------------------------------------------------------
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Process from Point 12.000 to Point 13.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 10.717(CFS)
Time of concentration = 13.53 min.
Rainfall intensity = 1.836(In/Hr) for a 100 year storm
Subarea runoff = 4.153(CFS) for 2.710(Ac.)
Total runoff = 12.412(CFS) Total area = 7.67(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	7.7	16.23	1.00	0.04	0.83	5.7	6.7	6.7
10	7.7	15.42	1.18	0.04	0.83	6.8	7.9	7.9
25	7.7	14.48	1.42	0.04	0.84	8.2	9.5	9.5
50	7.7	13.93	1.63	0.04	0.84	9.5	11.0	11.0

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       13.000 to Point       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   292.54(Ft.)
Downstream point elevation =   292.15(Ft.)
Pipe Slope = 0.0030 Ft/Ft
Pipe length  =   130.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.412(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.259(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.815(Ft.)
 Minor friction loss =      2.835(Ft.)  K-factor =   3.70
Pipe flow velocity =      7.02(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    13.84 min.
-------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     6.673(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.954(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.524(Ft.)
 Minor friction loss =      0.819(Ft.)  K-factor =   3.70
Pipe flow velocity =      3.78(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     7.879(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.483(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.731(Ft.)
 Minor friction loss =      1.142(Ft.)  K-factor =   3.70
Pipe flow velocity =      4.46(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     9.538(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.355(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.072(Ft.)
 Minor friction loss =      1.674(Ft.)  K-factor =   3.70
Pipe flow velocity =      5.40(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    11.014(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     3.270(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.429(Ft.)
 Minor friction loss =      2.232(Ft.)  K-factor =   3.70
Pipe flow velocity =      6.23(Ft/s)
-------------------------------------------------------------------
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Process from Point 13.000 to Point 14.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 11.621(CFS)
Time of concentration = 13.84 min.
Rainfall intensity = 1.809(In/Hr) for a 100 year storm
Subarea runoff = 1.043(CFS) for 0.770(Ac.)
Total runoff = 13.456(CFS) Total area = 8.44(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	8.4	16.60	0.99	0.04	0.83	6.2	7.2	7.2
10	8.4	15.77	1.16	0.04	0.83	7.3	8.5	8.5
25	8.4	14.81	1.40	0.04	0.84	8.9	10.3	10.3
50	8.4	14.25	1.61	0.04	0.84	10.3	11.9	11.9

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Process from Point       14.000 to Point       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   292.15(Ft.)
Downstream point elevation =   290.85(Ft.)
Pipe Slope = 0.0049 Ft/Ft
Pipe length  =   268.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.456(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    13.456(CFS)
Normal flow depth in pipe =   14.48(In.)
Flow top width inside pipe =   29.98(In.)
Critical Depth =   14.79(In.)
Pipe flow velocity =      5.73(Ft/s)
Travel time through pipe =    0.78 min.
Time of concentration (TC) =    14.62 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     7.232(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     7.232(CFS)
Normal flow depth in pipe =   10.29(In.)
Flow top width inside pipe =   28.48(In.)
Critical Depth =   10.71(In.)
Pipe flow velocity =      4.85(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     8.540(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =     8.540(CFS)
Normal flow depth in pipe =   11.25(In.)
Flow top width inside pipe =   29.05(In.)
Critical Depth =   11.67(In.)
Pipe flow velocity =      5.08(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    10.339(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    10.339(CFS)
Normal flow depth in pipe =   12.48(In.)
Flow top width inside pipe =   29.57(In.)
Critical Depth =   12.89(In.)
Pipe flow velocity =      5.35(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    11.939(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    11.939(CFS)
Normal flow depth in pipe =   13.52(In.)
Flow top width inside pipe =   29.85(In.)
Critical Depth =   13.90(In.)
Pipe flow velocity =      5.56(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 14.000 to Point 15.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 17.593(CFS)
Time of concentration = 14.62 min.
Rainfall intensity = 1.746(In/Hr) for a 100 year storm
Subarea runoff = 6.898(CFS) for 4.800(Ac.)
Total runoff = 20.354(CFS) Total area = 13.24(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	13.2	17.54	0.96	0.04	0.83	9.4	10.9	10.9
10	13.2	16.66	1.12	0.04	0.83	11.1	12.9	12.9
25	13.2	15.64	1.35	0.04	0.84	13.5	15.6	15.6
50	13.2	15.05	1.55	0.04	0.84	15.6	18.1	18.1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       15.000 to Point       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   290.35(Ft.)
Downstream point elevation =   289.61(Ft.)
Pipe Slope = 0.0035 Ft/Ft
Pipe length  =   212.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    20.354(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    20.354(CFS)
Normal flow depth in pipe =   18.35(In.)
Flow top width inside pipe =   35.99(In.)
Critical Depth =   17.38(In.)
Pipe flow velocity =      5.62(Ft/s)
Travel time through pipe =    0.63 min.
Time of concentration (TC) =    15.24 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    10.933(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    10.933(CFS)
Normal flow depth in pipe =   12.96(In.)
Flow top width inside pipe =   34.56(In.)
Critical Depth =   12.57(In.)
Pipe flow velocity =      4.77(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    12.912(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    12.912(CFS)
Normal flow depth in pipe =   14.18(In.)
Flow top width inside pipe =   35.18(In.)
Critical Depth =   13.70(In.)
Pipe flow velocity =      4.99(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    15.636(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.636(CFS)
Normal flow depth in pipe =   15.76(In.)
Flow top width inside pipe =   35.72(In.)
Critical Depth =   15.13(In.)
Pipe flow velocity =      5.25(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    18.058(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    18.058(CFS)
Normal flow depth in pipe =   17.11(In.)
Flow top width inside pipe =   35.96(In.)
Critical Depth =   16.33(In.)
Pipe flow velocity =      5.45(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 15.000 to Point 16.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 18.579(CFS)
Time of concentration = 15.24 min.
Rainfall intensity = 1.699(In/Hr) for a 100 year storm
Subarea runoff = 1.127(CFS) for 1.130(Ac.)
Total runoff = 21.481(CFS) Total area = 14.37(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	14.4	18.29	0.93	0.04	0.83	10.0	11.5	11.5
10	14.4	17.38	1.09	0.04	0.83	11.7	13.6	13.6
25	14.4	16.31	1.31	0.04	0.84	14.2	16.5	16.5
50	14.4	15.70	1.51	0.04	0.84	16.5	19.1	19.1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       16.000 to Point       17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   289.61(Ft.)
Downstream point elevation =   289.02(Ft.)
Pipe Slope = 0.0030 Ft/Ft
Pipe length  =   197.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.481(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    21.481(CFS)
Normal flow depth in pipe =   19.85(In.)
Flow top width inside pipe =   35.81(In.)
Critical Depth =   17.86(In.)
Pipe flow velocity =      5.37(Ft/s)
Travel time through pipe =    0.61 min.
Time of concentration (TC) =    15.86 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    11.532(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    11.532(CFS)
Normal flow depth in pipe =   13.90(In.)
Flow top width inside pipe =   35.05(In.)
Critical Depth =   12.91(In.)
Pipe flow velocity =      4.58(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    13.622(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    13.622(CFS)
Normal flow depth in pipe =   15.23(In.)
Flow top width inside pipe =   35.57(In.)
Critical Depth =   14.09(In.)
Pipe flow velocity =      4.79(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    16.499(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    16.499(CFS)
Normal flow depth in pipe =   16.97(In.)
Flow top width inside pipe =   35.94(In.)
Critical Depth =   15.55(In.)
Pipe flow velocity =      5.03(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    19.057(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    19.057(CFS)
Normal flow depth in pipe =   18.47(In.)
Flow top width inside pipe =   35.99(In.)
Critical Depth =   16.79(In.)
Pipe flow velocity =      5.22(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 16.000 to Point 17.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 27.840(CFS)
Time of concentration = 15.86 min.
Rainfall intensity = 1.656(In/Hr) for a 100 year storm
Subarea runoff = 10.688(CFS) for 7.720(Ac.)
Total runoff = 32.169(CFS) Total area = 22.09(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	22.1	19.03	0.91	0.04	0.83	14.9	17.3	17.3
10	22.1	18.08	1.06	0.04	0.83	17.6	20.4	20.4
25	22.1	16.97	1.28	0.04	0.84	21.3	24.7	24.7
50	22.1	16.33	1.47	0.04	0.84	24.7	28.5	28.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       17.000 to Point       10.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   289.02(Ft.)
Downstream point elevation =   285.25(Ft.)
Pipe Slope = 0.0047 Ft/Ft
Pipe length  =   797.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    32.169(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    32.169(CFS)
Normal flow depth in pipe =   22.22(In.)
Flow top width inside pipe =   35.00(In.)
Critical Depth =   22.08(In.)
Pipe flow velocity =      7.02(Ft/s)
Travel time through pipe =    1.89 min.
Time of concentration (TC) =    17.75 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    17.261(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    17.261(CFS)
Normal flow depth in pipe =   15.30(In.)
Flow top width inside pipe =   35.59(In.)
Critical Depth =   15.95(In.)
Pipe flow velocity =      6.03(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    20.393(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    20.393(CFS)
Normal flow depth in pipe =   16.80(In.)
Flow top width inside pipe =   35.92(In.)
Critical Depth =   17.41(In.)
Pipe flow velocity =      6.30(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    24.704(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    24.704(CFS)
Normal flow depth in pipe =   18.82(In.)
Flow top width inside pipe =   35.96(In.)
Critical Depth =   19.24(In.)
Pipe flow velocity =      6.61(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    28.536(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    28.536(CFS)
Normal flow depth in pipe =   20.55(In.)
Flow top width inside pipe =   35.64(In.)
Critical Depth =   20.73(In.)
Pipe flow velocity =      6.84(Ft/s)
----------------------------------------------------------------------
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       17.000 to Point       10.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     22.090(Ac.)
Runoff from this stream =     32.169(CFS)
Time of concentration =   17.75 min.
Rainfall intensity =     1.539(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3
```

++
Process from Point 19.000 to Point 23.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 650.000(Ft.)
Top (of initial area) elevation = 300.000(Ft.)
Bottom (of initial area) elevation = 298.700(Ft.)
Difference in elevation = 1.300(Ft.)
Slope = 0.00200 s(%)= 0.20
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.055 min.
Rainfall intensity = 1.791(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 12.567(CFS)
Subarea runoff = 14.547(CFS)
Total initial stream area = 9.220(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	9.2	14.06	1.10	0.04	0.83	7.6	8.8	8.8
10	9.2	14.06	1.25	0.04	0.83	8.7	10.1	10.1
25	9.2	14.06	1.45	0.04	0.84	10.1	11.7	11.7
50	9.2	14.06	1.62	0.04	0.84	11.3	13.2	13.2

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       23.000 to Point       24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   285.73(Ft.)
Downstream point elevation =   284.33(Ft.)
Pipe Slope = 0.0030 Ft/Ft
Pipe length  =   465.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.547(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    14.547(CFS)
Normal flow depth in pipe =   14.73(In.)
Flow top width inside pipe =   40.08(In.)
Critical Depth =   13.91(In.)
Pipe flow velocity =      4.83(Ft/s)
Travel time through pipe =    1.60 min.
Time of concentration (TC) =    15.66 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     8.841(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =     8.841(CFS)
Normal flow depth in pipe =   11.38(In.)
Flow top width inside pipe =   37.33(In.)
Critical Depth =   10.76(In.)
Pipe flow velocity =      4.20(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    10.080(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    10.080(CFS)
Normal flow depth in pipe =   12.16(In.)
Flow top width inside pipe =   38.10(In.)
Critical Depth =   11.52(In.)
Pipe flow velocity =      4.36(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    11.694(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    11.694(CFS)
Normal flow depth in pipe =   13.14(In.)
Flow top width inside pipe =   38.94(In.)
Critical Depth =   12.44(In.)
Pipe flow velocity =      4.55(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    13.164(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    13.164(CFS)
Normal flow depth in pipe =   13.97(In.)
Flow top width inside pipe =   39.58(In.)
Critical Depth =   13.22(In.)
Pipe flow velocity =      4.70(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 23.000 to Point 24.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 20.190(CFS)
Time of concentration = 15.66 min.
Rainfall intensity = 1.670(In/Hr) for a 100 year storm
Subarea runoff = 8.787(CFS) for 6.670(Ac.)
Total runoff = 23.334(CFS) Total area = 15.89(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	15.9	18.79	0.91	0.04	0.83	10.8	12.5	12.5
10	15.9	17.85	1.07	0.04	0.83	12.8	14.8	14.8
25	15.9	16.75	1.29	0.04	0.84	15.5	17.9	17.9
50	15.9	16.13	1.49	0.04	0.84	17.9	20.7	20.7

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       24.000 to Point       10.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   284.33(Ft.)
Downstream point elevation =   283.81(Ft.)
Pipe Slope = 0.0030 Ft/Ft
Pipe length  =   175.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.334(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    23.334(CFS)
Normal flow depth in pipe =   19.08(In.)
Flow top width inside pipe =   41.82(In.)
Critical Depth =   17.82(In.)
Pipe flow velocity =      5.49(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    16.19 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    12.522(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    12.522(CFS)
Normal flow depth in pipe =   13.62(In.)
Flow top width inside pipe =   39.32(In.)
Critical Depth =   12.86(In.)
Pipe flow velocity =      4.64(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    14.794(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    14.794(CFS)
Normal flow depth in pipe =   14.86(In.)
Flow top width inside pipe =   40.16(In.)
Critical Depth =   14.04(In.)
Pipe flow velocity =      4.86(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    17.920(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    17.920(CFS)
Normal flow depth in pipe =   16.48(In.)
Flow top width inside pipe =   41.01(In.)
Critical Depth =   15.52(In.)
Pipe flow velocity =      5.12(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    20.699(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    20.699(CFS)
Normal flow depth in pipe =   17.84(In.)
Flow top width inside pipe =   41.52(In.)
Critical Depth =   16.70(In.)
Pipe flow velocity =      5.32(Ft/s)
----------------------------------------------------------------------
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       24.000 to Point       10.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =     15.890(Ac.)
Runoff from this stream =     23.334(CFS)
Time of concentration =   16.19 min.
Rainfall intensity =     1.634(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    TC      Fm       Y     Rainfall Intensity
 No.    (CFS)     (min)   (In/Hr)  (In/Hr)  (In/Hr)


Summary of stream data:

Stream Flow rate      TC      Fm    Y     Rainfall Intensity
 No.       (CFS)       (min)  (In/Hr) (In/Hr)    (In/Hr)


1       25.943     22.43    0.038    0.846    1.322
2       32.169     17.75    0.038    0.846    1.539
3       23.334     16.19    0.038    0.846    1.634

The following analysis considers each stream individually as the
Q2,T2 (largest stream).  If equations do not apply, 1.000 is used.
The largest resulting flow rate is selected as governing flow.


      I2-Fm1    Y1*I2     I2   T2+T1
      ------    ----      --   -----   * Q1
      I1-Fm1    Y1*I1     I1    2*T1
Qmax(1) =
      1.000 * 1.000 * 1.000 * 1.000 * 25.943) +
      0.855 * 1.000 * 1.000 * 1.000 * 32.169) +
      0.804 * 1.000 * 1.000 * 1.000 * 23.334) + =      72.223
Qmax(2) =
      1.000 * 1.000 * 1.000 * 0.896 * 25.943) +
      1.000 * 1.000 * 1.000 * 1.000 * 32.169) +
      0.941 * 1.000 * 1.000 * 1.000 * 23.334) + =      77.352
Qmax(3) =
      1.000 * 1.000 * 1.000 * 0.861 * 25.943) +
      1.000 * 1.000 * 1.000 * 0.956 * 32.169) +
      1.000 * 1.000 * 1.000 * 1.000 * 23.334) + =      76.425

Total of 3 main streams to confluence:
Flow rates before confluence point:
      25.943      32.169      23.334
Maximum flow rates at confluence using above data:
       72.223       77.352       76.425
Area of stream before confluence:
       21.750       22.090       15.890
```

Effective area values after confluence:
59.730 54.637 50.819

Results of confluence:
Total flow rate = 77.352(CFS)
Time of concentration = 17.747 min.
Effective stream area after confluence = 54.637(Ac.)
Study area average Pervious fraction(Ap) = 0.100
Study area average soil loss rate(Fm) = 0.038(In/Hr)
Study area average yield Y = 0.846(In/Hr)
Study area average SCS CN = 80.000
Study area total = 59.73(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	54.6	21.30	0.84	0.04	0.83	34.3	39.5	39.5
10	54.6	20.23	0.99	0.04	0.83	40.5	46.7	46.7
25	54.6	18.99	1.19	0.04	0.84	49.0	56.7	56.7
50	54.6	18.28	1.37	0.04	0.84	56.7	65.5	65.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       10.000 to Point       25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   283.81(Ft.)
Downstream point elevation =   283.69(Ft.)
Pipe Slope = 0.0010 Ft/Ft
Pipe length  =   123.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    77.352(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    77.352(CFS)
Normal flow depth in pipe =   46.22(In.)
Flow top width inside pipe =   50.48(In.)
Critical Depth =   29.86(In.)
Pipe flow velocity =      4.77(Ft/s)
Travel time through pipe =    0.43 min.
Time of concentration (TC) =    18.18 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    39.546(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    39.546(CFS)
Normal flow depth in pipe =   29.30(In.)
Flow top width inside pipe =   59.98(In.)
Critical Depth =   21.05(In.)
Pipe flow velocity =      4.15(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    46.746(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    46.746(CFS)
Normal flow depth in pipe =   32.37(In.)
Flow top width inside pipe =   59.81(In.)
Critical Depth =   22.92(In.)
Pipe flow velocity =      4.33(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    56.655(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    56.655(CFS)
Normal flow depth in pipe =   36.56(In.)
Flow top width inside pipe =   58.55(In.)
Critical Depth =   25.36(In.)
Pipe flow velocity =      4.52(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    65.465(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    65.465(CFS)
Normal flow depth in pipe =   40.41(In.)
Flow top width inside pipe =   56.27(In.)
Critical Depth =   27.33(In.)
Pipe flow velocity =      4.65(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 10.000 to Point 25.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.115(In/Hr)
Minimum Q (Qmin=0.9YIA) = 63.965(CFS)
The area added to the existing stream causes a
a lower flow rate of Q = 73.751(CFS)
therefore the upstream flow rate of Q = 77.352(CFS) is being used
Time of concentration = 18.18 min.
Rainfall intensity = 1.515(In/Hr) for a 100 year storm
Subarea runoff = 0.000(CFS) for 0.830(Ac.)
Total runoff = 77.352(CFS) Total area = 55.47(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	55.5	21.81	0.83	0.04	0.83	34.3	39.5	39.5
10	55.5	20.72	0.97	0.04	0.83	40.4	46.7	46.7
25	55.5	19.45	1.17	0.04	0.84	49.0	56.6	56.7
50	55.5	18.72	1.35	0.04	0.84	56.7	65.4	65.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       25.000 to Point       26.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   283.69(Ft.)
Downstream point elevation =   282.65(Ft.)
Pipe Slope = 0.0015 Ft/Ft
Pipe length  =   690.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    77.352(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    77.352(CFS)
Normal flow depth in pipe =   39.38(In.)
Flow top width inside pipe =   57.00(In.)
Critical Depth =   29.86(In.)
Pipe flow velocity =      5.66(Ft/s)
Travel time through pipe =    2.03 min.
Time of concentration (TC) =    20.21 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    39.546(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    39.546(CFS)
Normal flow depth in pipe =   26.11(In.)
Flow top width inside pipe =   59.49(In.)
Critical Depth =   21.05(In.)
Pipe flow velocity =      4.83(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    46.746(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    46.746(CFS)
Normal flow depth in pipe =   28.69(In.)
Flow top width inside pipe =   59.94(In.)
Critical Depth =   22.92(In.)
Pipe flow velocity =      5.04(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    56.655(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    56.655(CFS)
Normal flow depth in pipe =   32.16(In.)
Flow top width inside pipe =   59.84(In.)
Critical Depth =   25.36(In.)
Pipe flow velocity =      5.29(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    65.465(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    65.465(CFS)
Normal flow depth in pipe =   35.20(In.)
Flow top width inside pipe =   59.09(In.)
Critical Depth =   27.33(In.)
Pipe flow velocity =      5.47(Ft/s)
----------------------------------------------------------------------
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       25.000 to Point       26.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     55.467(Ac.)
Runoff from this stream =     77.352(CFS)
Time of concentration =   20.21 min.
Rainfall intensity =     1.415(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

++
Process from Point 27.000 to Point 30.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 600.000(Ft.)
Top (of initial area) elevation = 300.000(Ft.)
Bottom (of initial area) elevation = 298.800(Ft.)
Difference in elevation = 1.200(Ft.)
Slope = 0.00200 s(%)= 0.20
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.612 min.
Rainfall intensity = 1.829(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 15.197(CFS)
Subarea runoff = 17.600(CFS)
Total initial stream area = 10.920(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	10.9	13.61	1.13	0.04	0.83	9.2	10.7	10.7
10	10.9	13.61	1.28	0.04	0.83	10.5	12.2	12.2
25	10.9	13.61	1.48	0.04	0.84	12.2	14.1	14.1
50	10.9	13.61	1.66	0.04	0.84	13.7	15.9	15.9

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       30.000 to Point       31.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   284.73(Ft.)
Downstream point elevation =   284.14(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   235.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.600(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    17.600(CFS)
Normal flow depth in pipe =   21.42(In.)
Flow top width inside pipe =   27.11(In.)
Critical Depth =   17.04(In.)
Pipe flow velocity =      4.70(Ft/s)
Travel time through pipe =    0.83 min.
Time of concentration (TC) =    14.45 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    10.699(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    10.699(CFS)
Normal flow depth in pipe =   15.39(In.)
Flow top width inside pipe =   29.99(In.)
Critical Depth =   13.13(In.)
Pipe flow velocity =      4.22(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    12.197(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    12.197(CFS)
Normal flow depth in pipe =   16.66(In.)
Flow top width inside pipe =   29.81(In.)
Critical Depth =   14.06(In.)
Pipe flow velocity =      4.36(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    14.149(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    14.149(CFS)
Normal flow depth in pipe =   18.33(In.)
Flow top width inside pipe =   29.25(In.)
Critical Depth =   15.21(In.)
Pipe flow velocity =      4.51(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    15.927(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    15.927(CFS)
Normal flow depth in pipe =   19.88(In.)
Flow top width inside pipe =   28.37(In.)
Critical Depth =   16.17(In.)
Pipe flow velocity =      4.61(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 30.000 to Point 31.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 17.071(CFS)
Time of concentration = 14.45 min.
Rainfall intensity = 1.759(In/Hr) for a 100 year storm
Subarea runoff = 2.154(CFS) for 1.830(Ac.)
Total runoff = 19.753(CFS) Total area = 12.75(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	12.8	17.34	0.96	0.04	0.83	9.1	10.6	10.7
10	12.8	16.47	1.13	0.04	0.83	10.8	12.5	12.5
25	12.8	15.46	1.36	0.04	0.84	13.1	15.2	15.2
50	12.8	14.88	1.57	0.04	0.84	15.1	17.5	17.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       31.000 to Point       32.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   284.14(Ft.)
Downstream point elevation =   283.12(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   410.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.753(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    19.753(CFS)
Normal flow depth in pipe =   23.67(In.)
Flow top width inside pipe =   24.48(In.)
Critical Depth =   18.09(In.)
Pipe flow velocity =      4.76(Ft/s)
Travel time through pipe =    1.44 min.
Time of concentration (TC) =    15.88 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    10.699(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    10.699(CFS)
Normal flow depth in pipe =   15.38(In.)
Flow top width inside pipe =   29.99(In.)
Critical Depth =   13.13(In.)
Pipe flow velocity =      4.22(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    12.532(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    12.532(CFS)
Normal flow depth in pipe =   16.95(In.)
Flow top width inside pipe =   29.75(In.)
Critical Depth =   14.27(In.)
Pipe flow velocity =      4.39(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    15.175(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    15.175(CFS)
Normal flow depth in pipe =   19.20(In.)
Flow top width inside pipe =   28.80(In.)
Critical Depth =   15.77(In.)
Pipe flow velocity =      4.57(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    17.526(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    17.526(CFS)
Normal flow depth in pipe =   21.33(In.)
Flow top width inside pipe =   27.20(In.)
Critical Depth =   16.99(In.)
Pipe flow velocity =      4.69(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 31.000 to Point 32.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 26.450(CFS)
Time of concentration = 15.88 min.
Rainfall intensity = 1.654(In/Hr) for a 100 year storm
Subarea runoff = 10.810(CFS) for 8.260(Ac.)
Total runoff = 30.563(CFS) Total area = 21.01(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	21.0	19.06	0.91	0.04	0.83	14.2	16.4	16.4
10	21.0	18.11	1.06	0.04	0.83	16.7	19.4	19.4
25	21.0	16.99	1.28	0.04	0.84	20.3	23.5	23.5
50	21.0	16.36	1.47	0.04	0.84	23.4	27.1	27.1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       32.000 to Point       26.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   283.12(Ft.)
Downstream point elevation =   282.65(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   185.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.563(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.791(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.027(Ft.)
 Minor friction loss =      2.227(Ft.)  K-factor =   3.70
Pipe flow velocity =      6.23(Ft/s)
Travel time through pipe =    0.50 min.
Time of concentration (TC) =    16.38 min.
-------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    16.399(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    16.399(CFS)
Normal flow depth in pipe =   20.30(In.)
Flow top width inside pipe =   28.07(In.)
Critical Depth =   16.43(In.)
Pipe flow velocity =      4.64(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    19.374(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    19.374(CFS)
Normal flow depth in pipe =   23.20(In.)
Flow top width inside pipe =   25.12(In.)
Critical Depth =   17.93(In.)
Pipe flow velocity =      4.75(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    23.470(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.456(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.606(Ft.)
 Minor friction loss =      1.313(Ft.)  K-factor =   3.70
Pipe flow velocity =      4.78(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    27.111(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.098(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.808(Ft.)
 Minor friction loss =      1.753(Ft.)  K-factor =   3.70
Pipe flow velocity =      5.52(Ft/s)
-------------------------------------------------------------------
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       32.000 to Point       26.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     21.010(Ac.)
Runoff from this stream =     30.563(CFS)
Time of concentration =   16.38 min.
Rainfall intensity =     1.622(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    TC      Fm       Y     Rainfall Intensity
 No.    (CFS)     (min)   (In/Hr)  (In/Hr)  (In/Hr)


Summary of stream data:

Stream Flow rate      TC      Fm    Y     Rainfall Intensity
 No.       (CFS)       (min)  (In/Hr) (In/Hr)    (In/Hr)


1       77.352     20.21    0.038    0.846    1.415
2       30.563     16.38    0.038    0.846    1.622

The following analysis considers each stream individually as the
Q2,T2 (largest stream).  If equations do not apply, 1.000 is used.
The largest resulting flow rate is selected as governing flow.


      I2-Fm1    Y1*I2     I2   T2+T1
      ------    ----      --   -----   * Q1
      I1-Fm1    Y1*I1     I1    2*T1
Qmax(1) =
      1.000 * 1.000 * 1.000 * 1.000 * 77.352) +
      0.869 * 1.000 * 1.000 * 1.000 * 30.563) + =     103.919
Qmax(2) =
      1.000 * 1.000 * 1.000 * 0.905 * 77.352) +
      1.000 * 1.000 * 1.000 * 1.000 * 30.563) + =     100.584

Total of 2 main streams to confluence:
Flow rates before confluence point:
      77.352      30.563
Maximum flow rates at confluence using above data:
      103.919      100.584
Area of stream before confluence:
       55.467       21.010
Effective area values after confluence:
       76.477       64.655


Results of confluence:
Total flow rate =    103.919(CFS)
Time of concentration =    20.208 min.
```

Effective stream area after confluence = 76.477(Ac.)
Study area average Pervious fraction(Ap) = 0.100
Study area average soil loss rate(Fm) = 0.038(In/Hr)
Study area average yield Y = 0.846(In/Hr)
Study area average SCS CN = 80.000
Study area total = 76.48(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	76.5	24.25	0.77	0.04	0.83	44.1	50.7	50.7
10	76.5	23.04	0.91	0.04	0.83	52.1	59.9	59.9
25	76.5	21.62	1.09	0.04	0.84	63.1	72.7	72.7
50	76.5	20.81	1.26	0.04	0.84	72.9	84.0	84.0

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       26.000 to Point       33.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   282.65(Ft.)
Downstream point elevation =   281.85(Ft.)
Pipe Slope = 0.0010 Ft/Ft
Pipe length  =   800.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   103.919(CFS)
Given pipe size =     60.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.126(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.273(Ft.)
 Minor friction loss =      0.652(Ft.)  K-factor =   1.50
Pipe flow velocity =      5.29(Ft/s)
Travel time through pipe =    2.52 min.
Time of concentration (TC) =    22.73 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    50.662(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    50.662(CFS)
Normal flow depth in pipe =   34.03(In.)
Flow top width inside pipe =   59.46(In.)
Critical Depth =   23.91(In.)
Pipe flow velocity =      4.41(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    59.924(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    59.924(CFS)
Normal flow depth in pipe =   37.97(In.)
Flow top width inside pipe =   57.84(In.)
Critical Depth =   26.11(In.)
Pipe flow velocity =      4.58(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    72.672(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    72.672(CFS)
Normal flow depth in pipe =   43.78(In.)
Flow top width inside pipe =   53.29(In.)
Critical Depth =   28.92(In.)
Pipe flow velocity =      4.73(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    84.005(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    84.005(CFS)
Normal flow depth in pipe =   50.34(In.)
Flow top width inside pipe =   44.10(In.)
Critical Depth =   31.17(In.)
Pipe flow velocity =      4.78(Ft/s)
----------------------------------------------------------------
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       26.000 to Point       33.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     76.477(Ac.)
Runoff from this stream =    103.919(CFS)
Time of concentration =   22.73 min.
Rainfall intensity =     1.311(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =   64.6656
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

++
Process from Point 34.000 to Point 35.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 300.000(Ft.)
Bottom (of initial area) elevation = 298.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00200 s(%)= 0.20
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 16.698 min.
Rainfall intensity = 1.601(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 2.291(CFS)
Subarea runoff = 2.645(CFS)
Total initial stream area = 1.880(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	1.9	16.70	0.99	0.04	0.83	1.4	1.6	1.6
10	1.9	16.70	1.12	0.04	0.83	1.6	1.8	1.8
25	1.9	16.70	1.29	0.04	0.84	1.8	2.1	2.1
50	1.9	16.70	1.45	0.04	0.84	2.1	2.4	2.4

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       35.000 to Point       36.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   286.78(Ft.)
Downstream point elevation =   285.14(Ft.)
Pipe Slope = 0.0026 Ft/Ft
Pipe length  =   625.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.645(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.645(CFS)
Normal flow depth in pipe =    8.91(In.)
Flow top width inside pipe =   18.00(In.)
Critical Depth =    7.40(In.)
Pipe flow velocity =      3.03(Ft/s)
Travel time through pipe =    3.44 min.
Time of concentration (TC) =    20.13 min.
WARNING: Travel time greater than 3 min. with TC less than 30 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     1.605(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.605(CFS)
Normal flow depth in pipe =    6.74(In.)
Flow top width inside pipe =   17.42(In.)
Critical Depth =    5.71(In.)
Pipe flow velocity =      2.66(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     1.831(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.831(CFS)
Normal flow depth in pipe =    7.24(In.)
Flow top width inside pipe =   17.65(In.)
Critical Depth =    6.10(In.)
Pipe flow velocity =      2.75(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     2.125(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.125(CFS)
Normal flow depth in pipe =    7.86(In.)
Flow top width inside pipe =   17.86(In.)
Critical Depth =    6.60(In.)
Pipe flow velocity =      2.87(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     2.393(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.393(CFS)
Normal flow depth in pipe =    8.41(In.)
Flow top width inside pipe =   17.96(In.)
Critical Depth =    7.02(In.)
Pipe flow velocity =      2.96(Ft/s)
----------------------------------------------------------------
```

++
Process from Point 35.000 to Point 36.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 4.143(CFS)
Time of concentration = 20.13 min.
Rainfall intensity = 1.418(In/Hr) for a 100 year storm
Subarea runoff = 2.124(CFS) for 1.960(Ac.)
Total runoff = 4.769(CFS) Total area = 3.84(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	3.8	24.16	0.78	0.04	0.83	2.2	2.6	2.6
10	3.8	22.95	0.91	0.04	0.83	2.6	3.0	3.0
25	3.8	21.54	1.10	0.04	0.84	3.2	3.7	3.7
50	3.8	20.74	1.26	0.04	0.84	3.7	4.2	4.2

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       36.000 to Point       37.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   285.14(Ft.)
Downstream point elevation =   281.94(Ft.)
Pipe Slope = 0.0024 Ft/Ft
Pipe length  =  1345.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.769(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.769(CFS)
Normal flow depth in pipe =   13.73(In.)
Flow top width inside pipe =   15.31(In.)
Critical Depth =   10.07(In.)
Pipe flow velocity =      3.29(Ft/s)
Travel time through pipe =    6.81 min.
Time of concentration (TC) =    26.94 min.
WARNING: Travel time greater than 3 min. with TC less than 30 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     2.550(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.550(CFS)
Normal flow depth in pipe =    8.98(In.)
Flow top width inside pipe =   18.00(In.)
Critical Depth =    7.26(In.)
Pipe flow velocity =      2.90(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     3.016(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.016(CFS)
Normal flow depth in pipe =    9.93(In.)
Flow top width inside pipe =   17.90(In.)
Critical Depth =    7.92(In.)
Pipe flow velocity =      3.02(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     3.658(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.658(CFS)
Normal flow depth in pipe =   11.25(In.)
Flow top width inside pipe =   17.43(In.)
Critical Depth =    8.76(In.)
Pipe flow velocity =      3.15(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     4.228(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.228(CFS)
Normal flow depth in pipe =   12.47(In.)
Flow top width inside pipe =   16.61(In.)
Critical Depth =    9.46(In.)
Pipe flow velocity =      3.24(Ft/s)
----------------------------------------------------------------
```

++
Process from Point 36.000 to Point 37.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 7.420(CFS)
Time of concentration = 26.94 min.
Rainfall intensity = 1.173(In/Hr) for a 100 year storm
Subarea runoff = 3.723(CFS) for 4.470(Ac.)
Total runoff = 8.491(CFS) Total area = 8.31(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	8.3	32.33	0.64	0.04	0.83	4.0	4.5	4.5
10	8.3	30.71	0.75	0.04	0.83	4.7	5.4	5.4
25	8.3	28.83	0.91	0.04	0.84	5.7	6.5	6.5
50	8.3	27.75	1.04	0.04	0.84	6.6	7.5	7.5

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       37.000 to Point       33.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   281.94(Ft.)
Downstream point elevation =   281.85(Ft.)
Pipe Slope = 0.0013 Ft/Ft
Pipe length  =    65.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.491(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     8.491(CFS)
Normal flow depth in pipe =   20.44(In.)
Flow top width inside pipe =   17.07(In.)
Critical Depth =   12.47(In.)
Pipe flow velocity =      2.98(Ft/s)
Travel time through pipe =    0.36 min.
Time of concentration (TC) =    27.30 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     4.518(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.518(CFS)
Normal flow depth in pipe =   12.69(In.)
Flow top width inside pipe =   23.96(In.)
Critical Depth =    8.96(In.)
Pipe flow velocity =      2.68(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     5.353(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     5.353(CFS)
Normal flow depth in pipe =   14.11(In.)
Flow top width inside pipe =   23.63(In.)
Critical Depth =    9.79(In.)
Pipe flow velocity =      2.79(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     6.502(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     6.502(CFS)
Normal flow depth in pipe =   16.10(In.)
Flow top width inside pipe =   22.55(In.)
Critical Depth =   10.84(In.)
Pipe flow velocity =      2.90(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     7.523(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     7.523(CFS)
Normal flow depth in pipe =   18.05(In.)
Flow top width inside pipe =   20.73(In.)
Critical Depth =   11.70(In.)
Pipe flow velocity =      2.97(Ft/s)
----------------------------------------------------------------------
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       37.000 to Point       33.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      8.310(Ac.)
Runoff from this stream =      8.491(CFS)
Time of concentration =   27.30 min.
Rainfall intensity =     1.163(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    TC      Fm       Y     Rainfall Intensity
 No.    (CFS)     (min)   (In/Hr)  (In/Hr)  (In/Hr)


Summary of stream data:

Stream Flow rate      TC      Fm    Y     Rainfall Intensity
 No.       (CFS)       (min)  (In/Hr) (In/Hr)    (In/Hr)


1      103.919     22.73    0.038   64.666    1.311
2        8.491     27.30    0.038    0.846    1.163

The following analysis considers each stream individually as the
Q2,T2 (largest stream).  If equations do not apply, 1.000 is used.
The largest resulting flow rate is selected as governing flow.


      I2-Fm1    Y1*I2     I2   T2+T1
      ------    ----      --   -----   * Q1
      I1-Fm1    Y1*I1     I1    2*T1
Qmax(1) =
      1.000 * 1.000 * 1.000 * 1.000 * 103.919) +
      1.000 * 1.000 * 1.000 * 0.916 * 8.491) + =     111.698
Qmax(2) =
      1.000 * 1.000 * 0.888 * 1.000 * 103.919) +
      1.000 * 1.000 * 1.000 * 1.000 * 8.491) + =     100.725

Total of 2 main streams to confluence:
Flow rates before confluence point:
     103.919       8.491
Maximum flow rates at confluence using above data:
      111.698      100.725
Area of stream before confluence:
       76.477        8.310
Effective area values after confluence:
       83.209       84.787


Results of confluence:
Total flow rate =    111.698(CFS)
Time of concentration =    22.727 min.
```

Effective stream area after confluence = 83.209(Ac.)
Study area average Pervious fraction(Ap) = 0.100
Study area average soil loss rate(Fm) = 0.038(In/Hr)
Study area average yield Y = 58.411(In/Hr)
Study area average SCS CN = 80.000
Study area total = 84.79(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	83.2	27.27	0.72	0.04	0.83	44.5	50.9	50.9
10	83.2	25.91	0.84	0.04	0.83	52.5	60.2	60.2
25	83.2	24.32	1.01	0.04	0.84	63.6	73.0	73.0
50	83.2	23.41	1.17	0.04	0.84	73.5	84.5	84.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       33.000 to Point       38.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   281.85(Ft.)
Downstream point elevation =   281.08(Ft.)
Pipe Slope = 0.0010 Ft/Ft
Pipe length  =   755.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   111.698(CFS)
Given pipe size =     60.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.367(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.388(Ft.)
 Minor friction loss =      0.754(Ft.)  K-factor =   1.50
Pipe flow velocity =      5.69(Ft/s)
Travel time through pipe =    2.21 min.
Time of concentration (TC) =    24.94 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    50.859(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    50.859(CFS)
Normal flow depth in pipe =   33.84(In.)
Flow top width inside pipe =   59.51(In.)
Critical Depth =   23.95(In.)
Pipe flow velocity =      4.46(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    60.196(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    60.196(CFS)
Normal flow depth in pipe =   37.73(In.)
Flow top width inside pipe =   57.97(In.)
Critical Depth =   26.20(In.)
Pipe flow velocity =      4.63(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    73.046(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    73.046(CFS)
Normal flow depth in pipe =   43.50(In.)
Flow top width inside pipe =   53.58(In.)
Critical Depth =   28.97(In.)
Pipe flow velocity =      4.79(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    84.470(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    84.470(CFS)
Normal flow depth in pipe =   49.88(In.)
Flow top width inside pipe =   44.94(In.)
Critical Depth =   31.27(In.)
Pipe flow velocity =      4.84(Ft/s)
----------------------------------------------------------------
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       33.000 to Point       38.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     83.209(Ac.)
Runoff from this stream =    111.698(CFS)
Time of concentration =   24.94 min.
Rainfall intensity =     1.234(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y = 4860.2794
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

++
Process from Point 39.000 to Point 40.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Initial subarea data:
Initial area flow distance = 200.000(Ft.)
Top (of initial area) elevation = 300.000(Ft.)
Bottom (of initial area) elevation = 299.600(Ft.)
Difference in elevation = 0.400(Ft.)
Slope = 0.00200 s(%)= 0.20
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.772 min.
Rainfall intensity = 2.433(In/Hr) for a 100 year storm
Minimum Q (Qmin=0.9YIA) = 4.222(CFS)
Subarea runoff = 4.915(CFS)
Total initial stream area = 2.280(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	2.3	8.77	1.50	0.04	0.83	2.5	3.0	3.0
10	2.3	8.77	1.70	0.04	0.83	2.9	3.4	3.4
25	2.3	8.77	1.97	0.04	0.84	3.4	4.0	4.0
50	2.3	8.77	2.21	0.04	0.84	3.8	4.5	4.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       40.000 to Point       41.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   284.74(Ft.)
Downstream point elevation =   283.93(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   325.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.915(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.915(CFS)
Normal flow depth in pipe =   13.80(In.)
Flow top width inside pipe =   15.22(In.)
Critical Depth =   10.22(In.)
Pipe flow velocity =      3.38(Ft/s)
Travel time through pipe =    1.60 min.
Time of concentration (TC) =    10.37 min.
----------------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     2.998(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.998(CFS)
Normal flow depth in pipe =    9.74(In.)
Flow top width inside pipe =   17.94(In.)
Critical Depth =    7.89(In.)
Pipe flow velocity =      3.07(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     3.414(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.414(CFS)
Normal flow depth in pipe =   10.57(In.)
Flow top width inside pipe =   17.72(In.)
Critical Depth =    8.45(In.)
Pipe flow velocity =      3.16(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     3.957(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.957(CFS)
Normal flow depth in pipe =   11.67(In.)
Flow top width inside pipe =   17.19(In.)
Critical Depth =    9.13(In.)
Pipe flow velocity =      3.27(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     4.451(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.451(CFS)
Normal flow depth in pipe =   12.71(In.)
Flow top width inside pipe =   16.40(In.)
Critical Depth =    9.72(In.)
Pipe flow velocity =      3.34(Ft/s)
----------------------------------------------------------------------
```

++
Process from Point 40.000 to Point 41.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 7.837(CFS)
Time of concentration = 10.37 min.
Rainfall intensity = 2.182(In/Hr) for a 100 year storm
Subarea runoff = 4.192(CFS) for 2.440(Ac.)
Total runoff = 9.107(CFS) Total area = 4.72(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	4.7	12.45	1.19	0.04	0.83	4.2	4.9	4.9
10	4.7	11.83	1.40	0.04	0.83	5.0	5.8	5.8
25	4.7	11.10	1.69	0.04	0.84	6.0	7.0	7.0
50	4.7	10.69	1.94	0.04	0.84	6.9	8.1	8.1

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       41.000 to Point       42.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   283.93(Ft.)
Downstream point elevation =   283.24(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   275.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.107(CFS)
Given pipe size =     21.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.644(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.908(Ft.)
 Minor friction loss =      0.423(Ft.)  K-factor =   1.90
Pipe flow velocity =      3.79(Ft/s)
Travel time through pipe =    1.21 min.
Time of concentration (TC) =    11.59 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =     4.910(CFS)
Given pipe size =     21.00(In.)
Calculated individual pipe flow  =     4.910(CFS)
Normal flow depth in pipe =   11.96(In.)
Flow top width inside pipe =   20.79(In.)
Critical Depth =    9.75(In.)
Pipe flow velocity =      3.47(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =     5.792(CFS)
Given pipe size =     21.00(In.)
Calculated individual pipe flow  =     5.792(CFS)
Normal flow depth in pipe =   13.34(In.)
Flow top width inside pipe =   20.22(In.)
Critical Depth =   10.63(In.)
Pipe flow velocity =      3.60(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =     7.005(CFS)
Given pipe size =     21.00(In.)
Calculated individual pipe flow  =     7.005(CFS)
Normal flow depth in pipe =   15.35(In.)
Flow top width inside pipe =   18.62(In.)
Critical Depth =   11.73(In.)
Pipe flow velocity =      3.72(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =     8.084(CFS)
Given pipe size =     21.00(In.)
Calculated individual pipe flow  =     8.084(CFS)
Normal flow depth in pipe =   17.63(In.)
Flow top width inside pipe =   15.43(In.)
Critical Depth =   12.65(In.)
Pipe flow velocity =      3.75(Ft/s)
----------------------------------------------------------------
```

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Process from Point 41.000 to Point 42.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 20.956(CFS)
Time of concentration = 11.59 min.
Rainfall intensity = 2.031(In/Hr) for a 100 year storm
Subarea runoff = 15.213(CFS) for 8.840(Ac.)
Total runoff = 24.320(CFS) Total area = 13.56(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	13.6	13.90	1.11	0.04	0.83	11.2	13.1	13.1
10	13.6	13.21	1.30	0.04	0.83	13.3	15.5	15.5
25	13.6	12.40	1.57	0.04	0.84	16.1	18.7	18.7
50	13.6	11.93	1.81	0.04	0.84	18.6	21.6	21.6

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       42.000 to Point       43.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   283.24(Ft.)
Downstream point elevation =   282.21(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   410.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.320(CFS)
Given pipe size =     30.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.987(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.441(Ft.)
 Minor friction loss =      0.572(Ft.)  K-factor =   1.50
Pipe flow velocity =      4.95(Ft/s)
Travel time through pipe =    1.38 min.
Time of concentration (TC) =    12.96 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    13.098(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    13.098(CFS)
Normal flow depth in pipe =   17.41(In.)
Flow top width inside pipe =   29.61(In.)
Critical Depth =   14.60(In.)
Pipe flow velocity =      4.43(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    15.456(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    15.456(CFS)
Normal flow depth in pipe =   19.45(In.)
Flow top width inside pipe =   28.65(In.)
Critical Depth =   15.91(In.)
Pipe flow velocity =      4.59(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    18.701(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    18.701(CFS)
Normal flow depth in pipe =   22.50(In.)
Flow top width inside pipe =   25.98(In.)
Critical Depth =   17.60(In.)
Pipe flow velocity =      4.74(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    21.586(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    21.586(CFS)
Normal flow depth in pipe =   26.34(In.)
Flow top width inside pipe =   19.63(In.)
Critical Depth =   18.96(In.)
Pipe flow velocity =      4.73(Ft/s)
----------------------------------------------------------------
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++
Process from Point 42.000 to Point 43.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 31.416(CFS)
Time of concentration = 12.96 min.
Rainfall intensity = 1.888(In/Hr) for a 100 year storm
Subarea runoff = 12.086(CFS) for 8.310(Ac.)
Total runoff = 36.406(CFS) Total area = 21.87(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	21.9	15.56	1.03	0.04	0.83	16.8	19.6	19.6
10	21.9	14.78	1.21	0.04	0.83	19.9	23.1	23.1
25	21.9	13.87	1.46	0.04	0.84	24.1	28.0	28.0
50	21.9	13.35	1.68	0.04	0.84	27.8	32.3	32.3

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Process from Point       43.000 to Point       44.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   282.21(Ft.)
Downstream point elevation =   281.50(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   285.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    36.406(CFS)
Given pipe size =     36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.755(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.849(Ft.)
 Minor friction loss =      0.618(Ft.)  K-factor =   1.50
Pipe flow velocity =      5.15(Ft/s)
Travel time through pipe =    0.92 min.
Time of concentration (TC) =    13.89 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    19.583(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    19.583(CFS)
Normal flow depth in pipe =   19.83(In.)
Flow top width inside pipe =   35.81(In.)
Critical Depth =   17.02(In.)
Pipe flow velocity =      4.90(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    23.117(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    23.117(CFS)
Normal flow depth in pipe =   22.05(In.)
Flow top width inside pipe =   35.07(In.)
Critical Depth =   18.59(In.)
Pipe flow velocity =      5.09(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    27.982(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    27.982(CFS)
Normal flow depth in pipe =   25.27(In.)
Flow top width inside pipe =   32.94(In.)
Critical Depth =   20.53(In.)
Pipe flow velocity =      5.28(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    32.307(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    32.307(CFS)
Normal flow depth in pipe =   28.55(In.)
Flow top width inside pipe =   29.17(In.)
Critical Depth =   22.13(In.)
Pipe flow velocity =      5.37(Ft/s)
----------------------------------------------------------------
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Process from Point 43.000 to Point 44.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil AMC II = 80.00
Pervious (Ap) = 0.100 Loss rate, Fm = 0.038(In/Hr), Fp = 0.380(In/Hr)
Subarea (Ai) = 0.9000; Subarea Yield Fraction(Y) = 0.846
Area Averaged (Ai) = 0.9000; Average Yield Fraction(Y) = 0.846
Area averaged Fm = 0.038(In/Hr), Area Averaged Fp = 0.380(In/Hr)
Minimum Q (Qmin=0.9YIA) = 37.668(CFS)
Time of concentration = 13.89 min.
Rainfall intensity = 1.805(In/Hr) for a 100 year storm
Subarea runoff = 7.204(CFS) for 5.550(Ac.)
Total runoff = 43.610(CFS) Total area = 27.42(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	27.4	16.66	0.99	0.04	0.83	20.2	23.4	23.4
10	27.4	15.83	1.16	0.04	0.83	23.8	27.7	27.7
25	27.4	14.86	1.40	0.04	0.84	28.9	33.5	33.5
50	27.4	14.30	1.61	0.04	0.84	33.4	38.7	38.7

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       44.000 to Point       38.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   281.50(Ft.)
Downstream point elevation =   281.08(Ft.)
Pipe Slope = 0.0025 Ft/Ft
Pipe length  =   170.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    43.610(CFS)
Given pipe size =     36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.488(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.727(Ft.)
 Minor friction loss =      2.187(Ft.)  K-factor =   3.70
Pipe flow velocity =      6.17(Ft/s)
Travel time through pipe =    0.46 min.
Time of concentration (TC) =    14.35 min.
----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    23.439(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    23.439(CFS)
Normal flow depth in pipe =   22.27(In.)
Flow top width inside pipe =   34.97(In.)
Critical Depth =   18.70(In.)
Pipe flow velocity =      5.11(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    27.677(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    27.677(CFS)
Normal flow depth in pipe =   25.03(In.)
Flow top width inside pipe =   33.14(In.)
Critical Depth =   20.39(In.)
Pipe flow velocity =      5.28(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    33.509(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    33.509(CFS)
Normal flow depth in pipe =   29.67(In.)
Flow top width inside pipe =   27.41(In.)
Critical Depth =   22.56(In.)
Pipe flow velocity =      5.38(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =    38.695(CFS)
Given pipe size =     36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.869(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.572(Ft.)
 Minor friction loss =      1.722(Ft.)  K-factor =   3.70
Pipe flow velocity =      5.47(Ft/s)
----------------------------------------------------------------
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       44.000 to Point       38.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     27.420(Ac.)
Runoff from this stream =     43.610(CFS)
Time of concentration =   14.35 min.
Rainfall intensity =     1.767(In/Hr)
Area averaged loss rate (Fm) =    0.0380(In/Hr)
Area averaged yield fraction Y =    0.8456
Area averaged SCS CN =  80.00
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    TC      Fm       Y     Rainfall Intensity
 No.    (CFS)     (min)   (In/Hr)  (In/Hr)  (In/Hr)


Summary of stream data:

Stream Flow rate      TC      Fm    Y     Rainfall Intensity
 No.       (CFS)       (min)  (In/Hr) (In/Hr)    (In/Hr)


1      111.698     24.94    0.038   4860.279    1.234
2       43.610     14.35    0.038    0.846    1.767

The following analysis considers each stream individually as the
Q2,T2 (largest stream).  If equations do not apply, 1.000 is used.
The largest resulting flow rate is selected as governing flow.


      I2-Fm1    Y1*I2     I2   T2+T1
      ------    ----      --   -----   * Q1
      I1-Fm1    Y1*I1     I1    2*T1
Qmax(1) =
      1.000 * 1.000 * 1.000 * 1.000 * 111.698) +
      0.691 * 1.000 * 1.000 * 1.000 * 43.610) + =     141.852
Qmax(2) =
      1.000 * 1.000 * 1.000 * 0.788 * 111.698) +
      1.000 * 1.000 * 1.000 * 1.000 * 43.610) + =     131.586

Total of 2 main streams to confluence:
Flow rates before confluence point:
     111.698      43.610
Maximum flow rates at confluence using above data:
      141.852      131.586
Area of stream before confluence:
       83.209       27.420
Effective area values after confluence:
      110.629       73.170


Results of confluence:
Total flow rate =    141.852(CFS)
Time of concentration =    24.939 min.
```

Effective stream area after confluence = 110.629(Ac.)
Study area average Pervious fraction(Ap) = 0.100
Study area average soil loss rate(Fm) = 0.038(In/Hr)
Study area average yield Y = 3655.841(In/Hr)
Study area average SCS CN = 80.000
Study area total = 110.63(Ac.)

******* DATA FOR OTHER YEAR STORMS *******

Year	Area (Ac)	TC (Min)	Intensity (In/Hr)	Fm Avg (In/Hr)	Y Avg (In/Hr)	Qmin (cfs)	Qcalc (cfs)	Qtot (cfs)
5	110.6	29.93	0.68	0.04	0.83	55.7	63.4	63.4
10	110.6	28.43	0.79	0.04	0.83	65.7	75.1	75.1
25	110.6	26.68	0.95	0.04	0.84	79.6	91.2	91.2
50	110.6	25.69	1.10	0.04	0.84	92.0	105.5	105.5

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point       38.000 to Point       39.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point elevation =   281.08(Ft.)
Downstream point elevation =   280.84(Ft.)
Pipe Slope = 0.0010 Ft/Ft
Pipe length  =   240.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   141.852(CFS)
Given pipe size =     60.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.687(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.712(Ft.)
 Minor friction loss =      1.216(Ft.)  K-factor =   1.50
Pipe flow velocity =      7.22(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =    25.49 min.
-----------------------------------------------------------------
       ******  OTHER STORM YEAR PIPE DATA  ******
** 5 year storm **
No. of pipes = 1  Required pipe flow  =    63.436(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    63.436(CFS)
Normal flow depth in pipe =   39.52(In.)
Flow top width inside pipe =   56.90(In.)
Critical Depth =   26.91(In.)
Pipe flow velocity =      4.63(Ft/s)
** 10 year storm **
No. of pipes = 1  Required pipe flow  =    75.122(CFS)
Given pipe size =     60.00(In.)
Calculated individual pipe flow  =    75.122(CFS)
Normal flow depth in pipe =   45.00(In.)
Flow top width inside pipe =   51.96(In.)
Critical Depth =   29.39(In.)
Pipe flow velocity =      4.75(Ft/s)
** 25 year storm **
No. of pipes = 1  Required pipe flow  =    91.205(CFS)
Given pipe size =     60.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.557(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.294(Ft.)
 Minor friction loss =      0.503(Ft.)  K-factor =   1.50
Pipe flow velocity =      4.65(Ft/s)
** 50 year storm **
No. of pipes = 1  Required pipe flow  =   105.505(CFS)
Given pipe size =     60.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.826(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.394(Ft.)
 Minor friction loss =      0.672(Ft.)  K-factor =   1.50
Pipe flow velocity =      5.37(Ft/s)
-----------------------------------------------------------------
End of computations, total study area =         117.300 (Ac.)
```

390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 1

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	Percent I avg.	Pervious CN	Pervious Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
Initial Area																			400.0	0.8	0.002		
2	3.0	3.0	D	Comm	90	90	80.0	0.38		11.6	2.03	0.04		0.85		4.7	5.5	5.5					
3	Pipe flow travel time								2.5	14.0									500.0	1.1	0.002	3.3	0.96
3	1.5	4.6	D	Comm	90	90	80.0	0.38	2.5	14.0	1.79	0.04	0.04	0.85	0.85	6.3	7.2	7.2					
4	Pipe flow travel time								1.0	15.0									185.0	0.3	0.002	3.1	1.27
4	1.6	6.2	D	Comm	90	90	80.0	0.38	1.0	15.0	1.72	0.04	0.04	0.85	0.85	8.0	9.3	9.3					
5	Pipe flow travel time								1.2	16.2									202.0	0.2	0.001	2.7	1.59
5	2.3	8.5	D	Comm	90	90	80.0	0.38	1.2	16.2	1.63	0.04	0.04	0.85	0.85	10.5	12.2	12.2					
6	Pipe flow travel time								1.8	18.0									377.0	0.6	0.001	3.5	1.52
6	0.8	9.3	D	Comm	90	90	80.0	0.38	1.8	18.0	1.53	0.04	0.04	0.85	0.85	10.8	12.5	12.5					
7	Pipe flow travel time								1.0	19.0									354.0	1.9	0.006	5.7	1.04
7	2.8	12.1	D	Comm	90	90	80.0	0.38	1.0	19.0	1.47	0.04	0.04	0.85	0.85	13.6	15.6	15.6					
8	Pipe flow travel time								1.4	20.4									350.0	0.7	0.002	4.2	1.61
8	4.0	16.1	D	Comm	90	90	80.0	0.38	1.4	20.4	1.41	0.04	0.04	0.85	0.85	17.3	19.9	19.9					
9	Pipe flow travel time								1.0	21.4									250.0	0.5	0.002	4.3	1.97
9	5.6	21.8	D	Comm	90	90	80.0	0.38	1.0	21.4	1.36	0.04	0.04	0.85	0.85	22.6	25.9	25.9					

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390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 2

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	Percent I avg.	Pervious CN	Pervious Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
10	Pipe flow travel time				1.0					22.4									367.0	1.2	0.003	5.7	1.67
** CONFLUENCE OF MAIN STREAMS **																							
10		21.8	Confluence - End of Stream							22.4	1.3							25.9					
Initial Area																			370.0	0.4	0.001		
12		5.0	5.0	D	Comm	90	90	80.0	0.38		13.0	1.89	0.04		0.85		7.1	8.3	8.3				
13	Pipe flow travel time				0.6					13.5									160.0	0.8	0.005	4.9	1.21
13		2.7	7.7	D	Comm	90	90	80.0	0.38	0.6	13.5	1.84	0.04	0.04	0.85	0.85	10.7	12.4	12.4				
14	Pipe flow travel time				0.3					13.8									130.0	0.4	0.003	6.2	1.43
14		0.8	8.4	D	Comm	90	90	80.0	0.38	0.3	13.8	1.81	0.04	0.04	0.85	0.85	11.6	13.5	13.5				
15	Pipe flow travel time				0.8					14.6									268.0	1.3	0.005	5.6	1.13
15		4.8	13.2	D	Comm	90	90	80.0	0.38	0.8	14.6	1.75	0.04	0.04	0.85	0.85	17.6	20.4	20.4				
16	Pipe flow travel time				0.6					15.2									212.0	0.7	0.003	5.5	1.43
16		1.1	14.4	D	Comm	90	90	80.0	0.38	0.6	15.2	1.70	0.04	0.04	0.85	0.85	18.6	21.5	21.5				
17	Pipe flow travel time				0.6					15.9									197.0	0.6	0.003	5.2	1.54
17		7.7	22.1	D	Comm	90	90	80.0	0.38	0.6	15.9	1.66	0.04	0.04	0.85	0.85	27.8	32.2	32.2				
10	Pipe flow travel time				1.9					17.7									797.0	3.8	0.005	6.8	1.71

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390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 3

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	avg.	Pervious CN	Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
** CONFLUENCE OF MAIN STREAMS **																							
10		22.1	Confluence - End of Stream							17.7	1.5							32.2					
Initial Area																			650.0	1.3	0.002		
23	9.2	9.2	D	Comm	90	90	80.0	0.38		14.1	1.79	0.04		0.85		12.6	14.5	14.5					
24	Pipe flow travel time								1.6	15.7									465.0	1.4	0.003	4.7	1.16
24	6.7	15.9	D	Comm	90	90	80.0	0.38	1.6	15.7	1.67	0.04	0.04	0.85	0.85	20.2	23.3	23.3					
10	Pipe flow travel time								0.5	16.2									175.0	0.5	0.003	5.3	1.49
** CONFLUENCE OF MAIN STREAMS **																							

Confluence Analysis

Tc1= 22.4	Tc2= 17.7	Tc3= 16.2	Tc4= 0.0	Tc5= 0.0
Q1= 25.9	Q2= 32.2	Q3= 32.2	Q4= 0.0	Q5= 0.0
I1= 1.32	I2= 1.54	I3= 1.63	I4= 0.00	I5= 0.00
AR1= 21.8	AR2= 22.1	AR3= 15.9	AR4= 0.0	AR5= 0.0
EA1= 59.7	EA2= 54.6	EA3= 50.8	EA4= 0.0	EA5= 0.0
Fm1= 0.04	Fm2= 0.04	Fm3= 0.04	Fm4= 0.00	Fm5= 0.00
Y1 = 0.85	Y2 = 0.85	Y3 = 0.85	Y4 = 0.00	Y5 = 0.00
Qt1= 72.2	Qt2= 77.4	Qt3= 76.4	Qt4= 0.0	Qt5= 0.0

Largest Confluence
Q= 77.4

Eff Area = 54.6

10		54.6	Confluence - End of Confluence							17.7	1.6							77.4					
25	Pipe flow travel time								0.4	18.2									123.0	0.1	0.001	4.7	3.37
25	0.8	55.5	D	Comm	90	90	80.0	0.38	0.4	18.2	1.52	0.04	0.04	0.85	0.85	64.0	73.8	77.4					
26	Pipe flow travel time								2.0	20.2									690.0	1.0	0.002	5.5	2.93
** CONFLUENCE OF MAIN STREAMS **																							
26		55.5	Confluence - End of Stream							20.2	1.4							77.4					

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390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 4

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	avg.	Pervious CN	Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
Initial Area																			600.0	1.2	0.002		
30	10.9	10.9	D	Comm	90	90	80.0	0.38		13.6	1.83	0.04		0.85		15.2	17.6	17.6					
31	Pipe flow travel time								0.8	14.4									235.0	0.6	0.002	4.6	1.66
31	1.8	12.8	D	Comm	90	90	80.0	0.38	0.8	14.4	1.76	0.04	0.04	0.85	0.85	17.1	19.8	19.8					
32	Pipe flow travel time								1.4	15.9									410.0	1.0	0.002	4.7	1.78
32	8.3	21.0	D	Comm	90	90	80.0	0.38	1.4	15.9	1.65	0.04	0.04	0.85	0.85	26.5	30.6	30.6					
26	Pipe flow travel time								0.5	16.4									185.0	0.5	0.003	5.5	0.81
** CONFLUENCE OF MAIN STREAMS **																							
Confluence Analysis																							

Tc1= 20.2 Tc2= 16.4 Tc3= 0.0 Tc4= 0.0 Tc5= 0.0
Q1= 77.4 Q2= 30.6 Q3= 30.6 Q4= 0.0 Q5= 0.0
I1= 1.41 I2= 1.62 I3= 0.00 I4= 0.00 I5= 0.00
AR1= 55.5 AR2= 21.0 AR3= 0.0 AR4= 0.0 AR5= 0.0
EA1= 76.5 EA2= 64.7 EA3= 0.0 EA4= 0.0 EA5= 0.0
Fm1= 0.04 Fm2= 0.04 Fm3= 0.00 Fm4= 0.00 Fm5= 0.00
Y1 = 0.85 Y2 = 0.85 Y3 = 0.00 Y4 = 0.00 Y5 = 0.00
Qt1=103.9 Qt2=100.6 Qt3= 0.0 Qt4= 0.0 Qt5= 0.0

Largest Confluence Q= 103.9

Eff Area = 76.5

26		76.5	Confluence - End of Confluence							20.2	1.6							103.9					
33	Pipe flow travel time								2.5	22.7									800.0	0.8	0.001	4.8	4.20
** CONFLUENCE OF MAIN STREAMS **																							
33		76.5	Confluence - End of Stream							22.7	1.3							103.9					
Initial Area																			1000.0	2.0	0.002		
35	1.9	1.9	D	Comm	90	90	80.0	0.38		16.7	1.60	0.04		0.85		2.3	2.6	2.6					

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390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 5

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	avg.	Pervious CN	Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
36	Pipe flow travel time								3.4	20.1									625.0	1.6	0.003	3.0	0.70
36	2.0	3.8	D	Comm	90	90	80.0	0.38	3.4	20.1	1.42	0.04	0.04	0.85	0.85	4.1	4.8	4.8					
37	Pipe flow travel time								6.8	26.9									1345.0	3.2	0.002	3.2	1.04
37	4.5	8.3	D	Comm	90	90	80.0	0.38	6.8	26.9	1.17	0.04	0.04	0.85	0.85	7.4	8.5	8.5					
33	Pipe flow travel time								0.4	27.3									65.0	0.1	0.001	3.0	1.50
** CONFLUENCE OF MAIN STREAMS **																							
Confluence Analysis																							
33		83.2	Confluence - End of Confluence							22.7	1.2							111.7					
38	Pipe flow travel time								2.2	24.9									755.0	0.8	0.001	4.8	4.16
** CONFLUENCE OF MAIN STREAMS **																							
38		83.2	Confluence - End of Stream							24.9	1.2							111.7					
Initial Area																			200.0	0.4	0.002		
40	2.3	2.3	D	Comm	90	90	80.0	0.38		8.8	2.43	0.04		0.85		4.2	4.9	4.9					
41	Pipe flow travel time								1.6	10.4									325.0	0.8	0.003	3.3	1.06

Confluence Analysis:

Tc1= 22.7	Tc2= 27.3	Tc3= 0.0	Tc4= 0.0	Tc5= 0.0
Q1=103.9	Q2= 8.5	Q3= 8.5	Q4= 0.0	Q5= 0.0
I1= 1.31	I2= 1.16	I3= 0.00	I4= 0.00	I5= 0.00
AR1= 76.5	AR2= 8.3	AR3= 0.0	AR4= 0.0	AR5= 0.0
EA1= 83.2	EA2= 84.8	EA3= 0.0	EA4= 0.0	EA5= 0.0
Fm1= 0.04	Fm2= 0.04	Fm3= 0.00	Fm4= 0.00	Fm5= 0.00
Y1 =64.67	Y2 = 0.85	Y3 = 0.00	Y4 = 0.00	Y5 = 0.00
Qt1=111.7	Qt2=100.7	Qt3= 0.0	Qt4= 0.0	Qt5= 0.0

Largest Confluence
Q= 111.7

Eff Area = 83.2

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390-04 GRAPEVINE
RLB 20130711

KERN COUNTY HYDROLOGY MANUAL: 1992 Rational Method Study Form

Study File Name: 390gpv.rhk 1-Hour Rainfall (Inches)= 0.70 Slope=0.65 Calculated by _____ Date:07/15/13

Storm Return Interval: 100 24-Hour Rainfall (Inches)= 2.50 K(T)=1.00 Checked by _____ Page 6

Cntr Pt	Sub-area	Total Area	Soil Type	Develp Type	Percent I ai	avg. CN	Pervious Fp	T(t) Min.	Tc Min.	I in/h	Fm in/h	Fm avg.	Y	Y avg.	Q Min.	Q Calc.	Q Total	Path Ft.	Elev Diff	Slope Ft/Ft	Vel fps	Dn Ft.
41	2.4	4.7	D	Comm	90	90	80.0	0.38	1.6	10.4	2.18	0.04	0.04	0.85	0.85	7.8	9.1	9.1				
42	Pipe flow travel time								1.2	11.6								275.0	0.7	0.002	3.7	1.47
42	8.8	13.6	D	Comm	90	90	80.0	0.38	1.2	11.6	2.03	0.04	0.04	0.85	0.85	21.0	24.3	24.3				
43	Pipe flow travel time								1.4	13.0								410.0	1.0	0.003	4.7	2.20
43	8.3	21.9	D	Comm	90	90	80.0	0.38	1.4	13.0	1.89	0.04	0.04	0.85	0.85	31.4	36.4	36.4				
44	Pipe flow travel time								0.9	13.9								285.0	0.7	0.002	5.4	2.38
44	5.5	27.4	D	Comm	90	90	80.0	0.38	0.9	13.9	1.81	0.04	0.04	0.85	0.85	37.7	43.6	43.6				
38	Pipe flow travel time								0.5	14.3								170.0	0.4	0.003	5.5	0.57
** CONFLUENCE OF MAIN STREAMS **																						

Confluence Analysis

Tc1= 24.9 Tc2= 14.3 Tc3= 0.0 Tc4= 0.0 Tc5= 0.0
Q1=111.7 Q2= 43.6 Q3= 43.6 Q4= 0.0 Q5= 0.0
I1= 1.23 I2= 1.77 I3= 0.00 I4= 0.00 I5= 0.00
AR1= 83.2 AR2= 27.4 AR3= 0.0 AR4= 0.0 AR5= 0.0
EA1=110.6 EA2= 73.2 EA3= 0.0 EA4= 0.0 EA5= 0.0
Fm1= 0.04 Fm2= 0.04 Fm3= 0.00 Fm4= 0.00 Fm5= 0.00
Y1 =4860.28 Y2 = 0.85 Y3 = 0.00 Y4 = 0.00 Y5 = 0.00
Qt1=141.9 Qt2=131.6 Qt3= 0.0 Qt4= 0.0 Qt5= 0.0

Largest Confluence Q= 141.9

Eff Area = 110.6

38		110.6	Confluence - End of Confluence						24.9	1.8								141.9				
39	Pipe flow travel time								0.6	25.5								240.0	0.2	0.001	5.4	0.39

Effective area = 110.63 (Ac.), Total study area = 117.30 (Ac.), Peak flow rate = 141.85 (CFS), AP =0.100, SCS CN = 80.00

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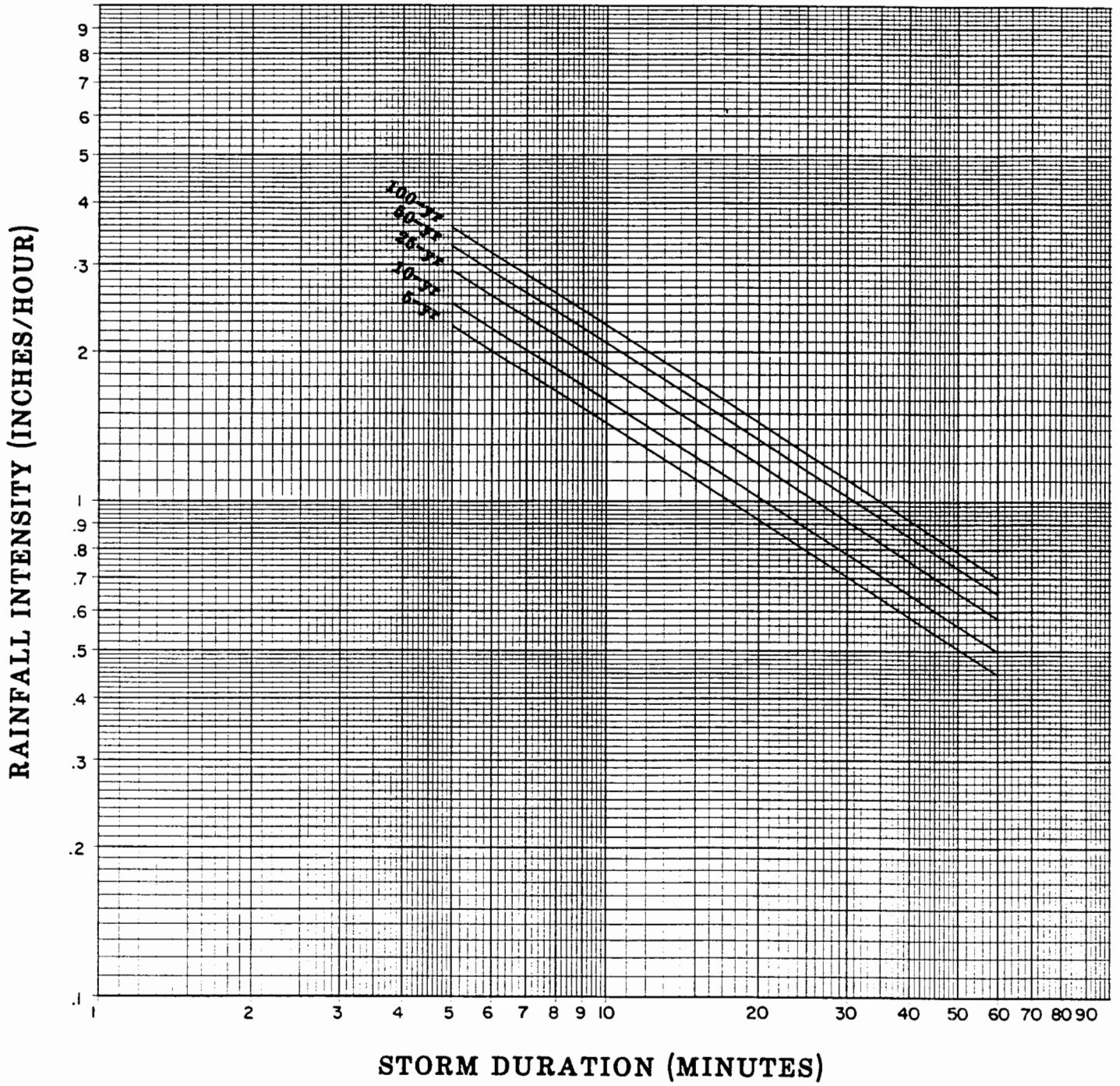
Sump Sizing

Per the city of Delano Standard 48-2.01 (b): *The retention basin capacity shall be based on one (1) acre foot for each eight (8) acres of commercial development in areas where M.A.P. is seven (7") inches.* Cornerstone has elected to provide capacity based on a 1 acre-ft per 6 acres of commercial development.

Table 1. – Sump Requirements			
Description	Area (ac.)	Volume Required (ac-ft)	Volume Provided (ac-ft)
Delano Marketplace	40	5	6.7
Grapevine Commercial	46	5.8	7.7
Grapevine Residential	34	4.25	5.7
		Total:	**20.1**



PROJECT LOCATION: Delano

KERN COUNTY
Hydrology Manual

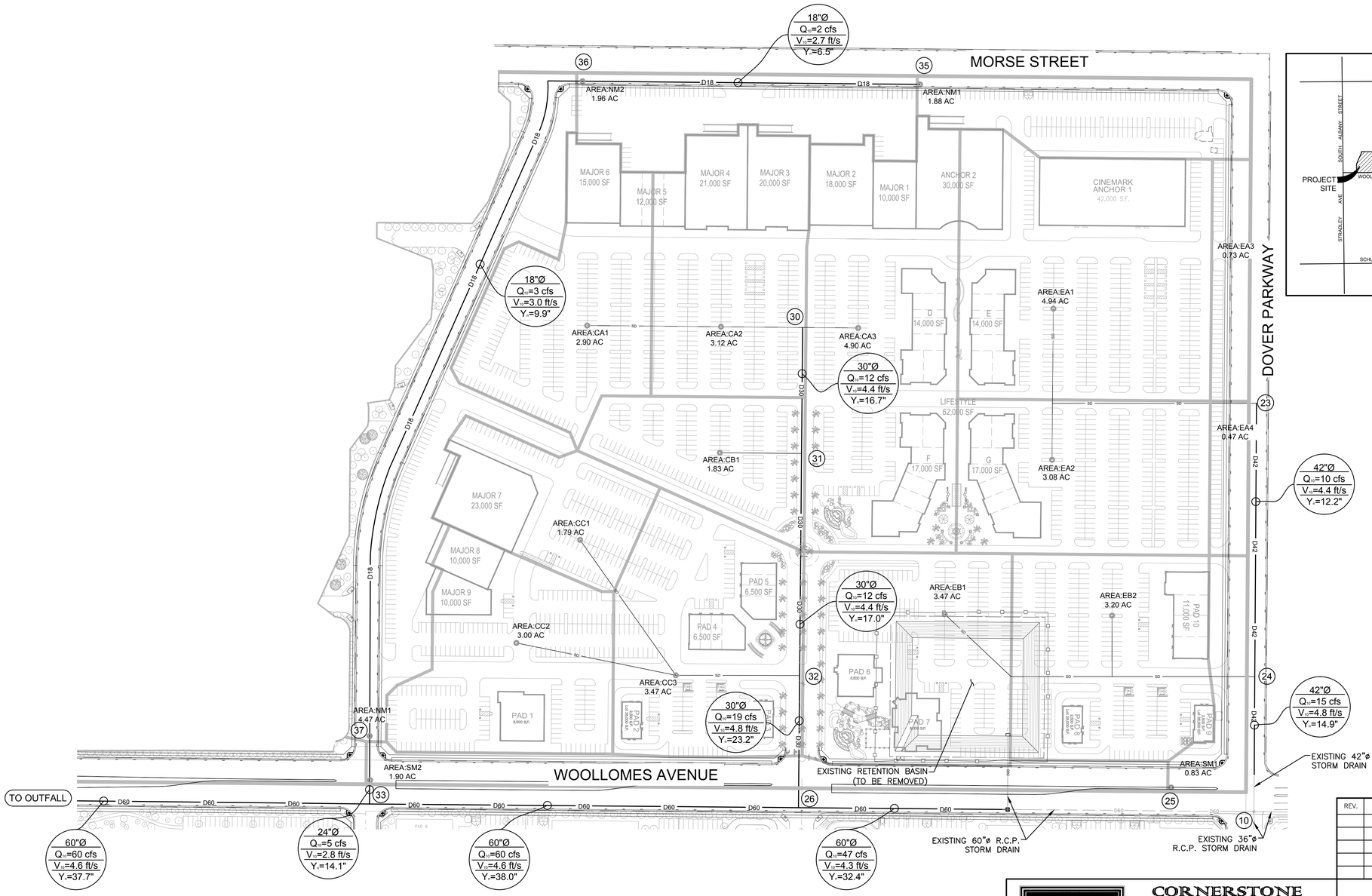
RAINFALL
INTENSITY-DURATION
FREQUENCY (IDF) CHART

Document Path: T:\GIS-Files\Project-Files\E1300901S - Grapevine Delano\Figure 3 site plan.mxd

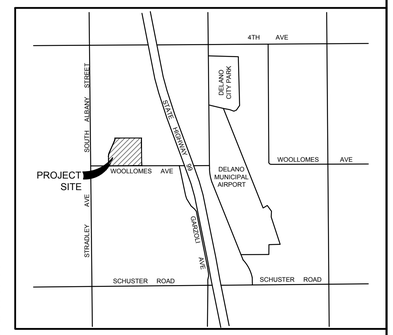
The Grapevine Project
NW Corner of Woollomes and S. Dover
Delano, California

Figure 1. Site Plan
BSK Project E1300901S

DELANO GRAPEVINE
EXHIBIT A
PRELIMINARY HYDROLOGY



GRAPHIC SCALE
100' 50' 0' 50' 100'
(IN FEET)
1 inch = 100 ft.



VICINITY MAP
NO SCALE

LEGEND

DRAINAGE AREA

D60 — PIPE DIAMETER

60"Ø Q10=60 cfs V10=4.6 ft/s Y7=37.7"
- PIPE DIAMETER
- 10-YEAR EVENT FLOWRATE
- 10-YEAR VELOCITY
- NORMAL DEPTH

REV.	DESCRIPTION	CK'D	DATE

CORNERSTONE ENGINEERING, INC.
208 OAK STREET
BAKERSFIELD, CA 93301
TEL: (661) 325-9474
FAX: (661) 322-0129
CONSULTING CIVIL ENGINEERING AND LAND SURVEYING
www.cornerstoneeng.com

CITY OF DELANO
DELANO GRAPEVINE
EXHIBIT A – PRELIMINARY HYDROLOGY

SHEET 1 OF 1

CORNERSTONE
ENGINEERING
CONSULTING CIVIL ENGINEERS & LAND SURVEYORS

September 18, 2013 Contract 390-04-01

Erik Ringelberg
BSK Associates
Engineers & Laboratories
3140 Gold Camp Drive, Suite 160
Rancho Cordova, CA 95670
P: 916.853.9293, ext.112
www.bskassociates.com

Civil Engineering
Surveying Services
Sewer & Water Engineering
Storm Water Engineering
Storm Water Quality SWPPP
Road And Street Engineering
School Site Engineering
Site Development, Planning And Surveying
Construction Staking Services
Redevelopment Area Enhancement Engineering
Traffic Engineering
Transportation Planning

RE: Delano Grapevine Earthwork

Mr. Ringelberg:

The purpose of this memorandum is to provide clarification & supplemental information for use in the completion of the Environmental Impact Report (EIR) regarding proposed improvements to the Delano Grapevine project site. Cornerstone Engineering has been contracted by the owner to provide preliminary grading analysis for the commercial portion (APN: 521-010-21) of the Delano Grapevine project site, approximately 46 acres. This includes establishing finished pad elevations and rough grading in and around the parking lot areas.

The Commercial portion of the Delano Grapevine project site consists of the eastern most 46 acres of an 80 acre site in the southwestern portion of Delano, CA. The 80 acre site is bounded by Wooollomes Ave, Dover Pkwy, Morse St, and Albany St. The existing site is undeveloped with approximately 9 feet of fall from the Northeast to the West. An existing stormwater sump is located in the southeast corner of the site.

A proposed surface model was created to represent rough grading limits. Finished pad elevations were established along with low points for surface runoff collection. The proposed surface was adjusted to represent the surface at subgrade and then compared to the existing ground surface. From this Cornerstone was able to define an earthwork volume required to complete the site grading. Cornerstone's analysis of the site can be observed in the attached Exhibit A.

From our findings it is anticipated that no imported soil will be required for the completion of the project grading. Any excess material will be relocated across Woollomes Ave to the vacant property (APN: 521-040-43) or to the western portion of the site (APN: 521-010-19), also owned by the developer. Estimated earthwork quantities can be observed in the attached Exhibit B.

Civil Engineering

Surveying Services

Sewer & Water Engineering

Storm Water Engineering

Storm Water Quality SWPPP

Road And Street Engineering

School Site Engineering

Site Development, Planning And Surveying

Construction Staking Services

Redevelopment Area Enhancement Engineering

Traffic Engineering

Transportation Planning

The proposed project will require the expansion of the existing city stormwater basin at the southeast corners of Woollomes Ave & Albany St (APN: 521-090-14). All stormwater generated from this project and the Delano Marketplace I site project will be routed to this basin. The additional stormwater storage required will be about 15 acre-feet. The excavation of this basin will generate approximately 24,000 cubic yards of soil export which will be relocated to adjacent properties (APN: 521-040-43, APN: 521-010-19, and/or APN: 521-010-21), also owned by the developer.

We hope this information provided is found to be satisfactory, however, if further clarification is needed please do not hesitate to contact us.

CORNERSTONE ENGINEERING, INC.

Richard L. Baker, E.I.T.
Project Manager

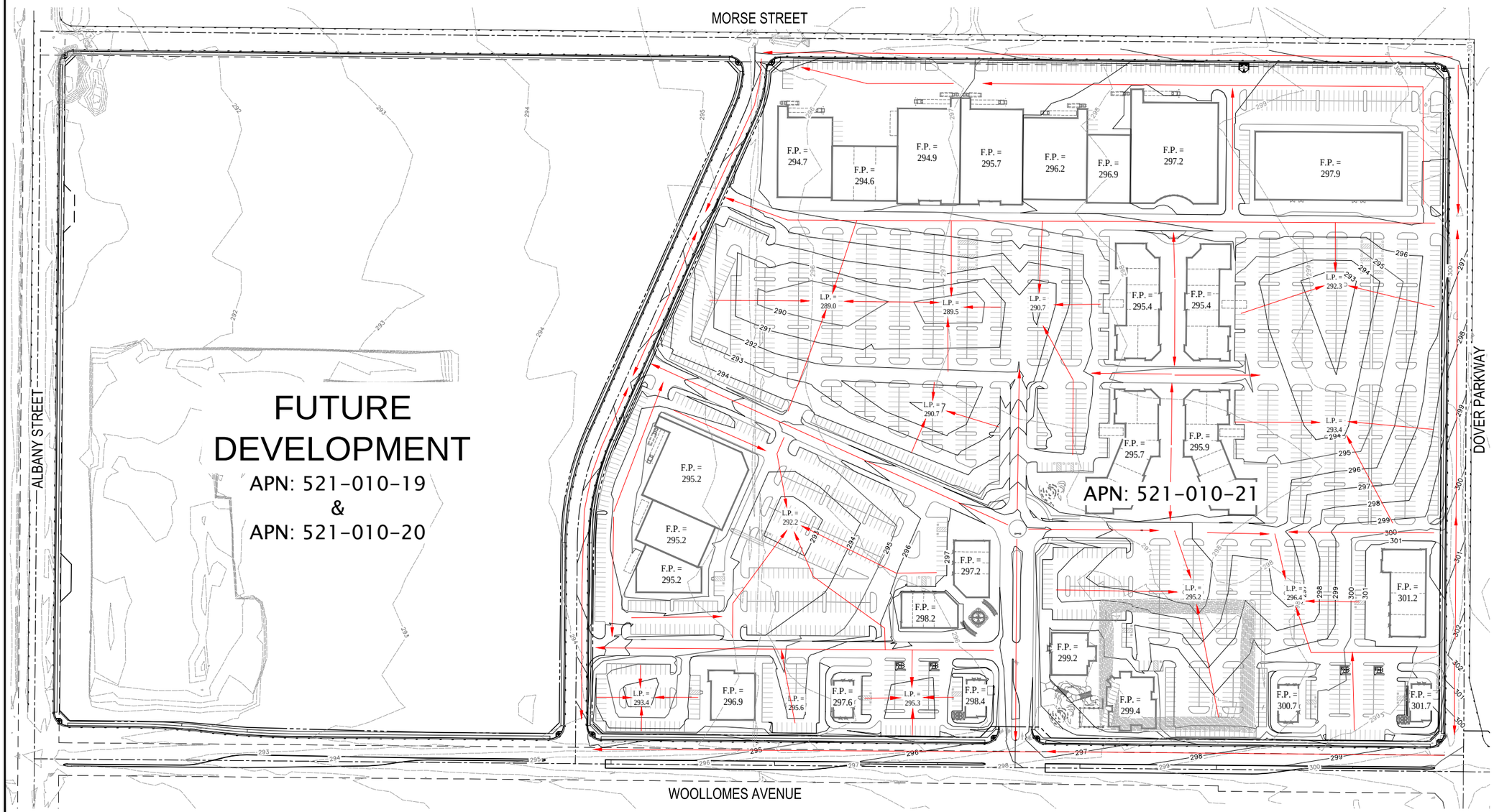
encl(3): (1) – Exhibit A – Preliminary Grading
(2) – Exhibit B – Preliminary Earthwork

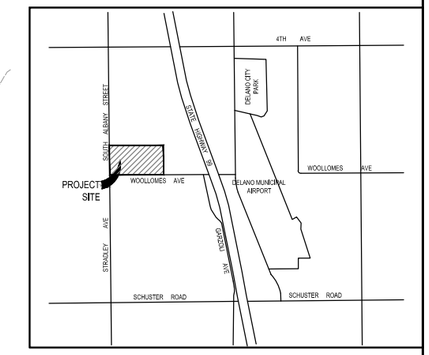
Cc via *electronic mail*: YK America LLC c/o Ms. Mimi Chang

DELANO GRAPEVINE
EXHIBIT A

PRELIMINARY GRADING

GRAPHIC SCALE
100' 50' 0' 50' 100'
(IN FEET)
1 inch = 100 ft.





VICINITY MAP
NO SCALE

LEGEND

F.P. = FINISHED PAD
L.P. = LOW POINT
= EXISTING CONTOUR
= PROPOSED CONTOUR
= DIRECTIONAL ARROW

REV.	DESCRIPTION	CK'D	DATE

CORNERSTONE ENGINEERING, INC.
717 PIER VIEW WAY
OCEANSIDE, CA 92054
TEL: (760) 722-3495
FAX: (760) 722-9490
208 OAK STREET
BAKERSFIELD, CA 93301
TEL: (661) 325-9474
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CONSULTING CIVIL ENGINEERING AND LAND SURVEYING
www.cornerstoneeng.com

CITY OF DELANO
DELANO GRAPEVINE
EXHIBIT A – PRELIMINARY GRADING

CORNERSTONE
ENGINEERING, INC.
CONSULTING CIVIL ENGINEERS & LAND SURVEYORS

EXHIBIT B
EARTHWORK CALCULATIONS SHEET

PARAMETERS		
Description	value	units
raw net cut	135,063	cu. Yds.
raw net fill	50,782	cu. Yds.
fill factor	1.5	
site area	46	ac.
overex area	370,327	sq. ft.
overex depth	4	ft.
clear & grub depth	0	in.
treat c & g as a vol?	n	(y or n)

(shrinkage equivalent)= 33%

CAD MISC.	
Project	390-04-01 (Commercial Site)
Drawing Name	390-04-01 Rough Grading
Stratum	N/A (C3D 2013)
Surface 1	Existing
Surface 2	Rough Grading

Pavement Section	
2.5/8.5	per (assumed, awaiting soils)

move pads 0.9 ft up

CALCULATIONS	
Description	value (cu. Yd.)
Volume Overex	54,863
Clear & grub Volume	0
Gross Volume	**31,458** Cut

Adjusted Cut	189,926
Adjusted Fill	158,468

Gross to Adjusted cut ratio= 17% (Idealy 10%)

SAMPLE CALCULATIONS

$$\text{Volume}_{\text{Overex}} = (\text{overex area}) * (\text{depth}_{ox}) * (1/27\ \text{yd}^3/\text{ft}^3)$$

$$= (370{,}327\ \text{ft}^2) * (4\ \text{ft}) * (1/27\ \text{yd}^3/\text{ft}^3) = 54{,}863$$

$$\text{Volume}_{\text{Clear \& grub}} = (\text{area}_{\text{ac.}}) * (43{,}560\ \text{ft}^2/\text{ac}) * (\text{depth}_{cg}/12\ \text{ft}) * (1/27\ \text{yd}^3/\text{ft}^3)$$

$$= (46.000\ \text{ac.}) * (43{,}560\ \text{ft}^2/\text{ac}) * (0/12\ \text{ft}) * (1/27\ \text{yd}^3/\text{ft}^3) = 0$$

$$\text{Volume}_{\text{Gross}} = [(\text{Raw} + \text{Overex} + \text{Clear \& Grub}) * \text{Fill Factor}] - [\text{Raw Cut} + \text{Overex}]$$

$$= [(50{,}782 + 54{,}863 + 0) * 1.5] - [135{,}063 + 54{,}863] = \text{######}$$

208 Oak St, Bakersfield, CA. 93304 Tel: 661.325.9474 - Fax: 661.322.0129

APPENDIX 3.10

NOISE STUDIES

BSK

3140 Gold Camp Drive, Suite 160
Rancho Cordova, CA 95670
P 916.853.9293
F 916.853.9297
www.bskassociates.com

Technical Memorandum

Subject: Grapevine Shopping Center Sound Study for the City of Delano

Date: December 6, 2013

Prepared By: Erik Ringelberg, Lucinda Calvo, and Kevin Grove, BSK Associates

The purpose of this study was to provide a synoptic assessment of the ambient sound conditions at the proposed Delano Grapevine Shopping Center and the potential for construction and operations sound impacts from the project on the nearest sensitive receptors.

The Delano Grapevine Shopping Center project description and site plan identify the proposed development of an open-air mall, restaurants, and a movie theater. The project is also expected to increase local vehicle traffic. These types of projects are not typically associated with significant increases in noise common to commercial areas, except potentially during construction. The nearest existing sensitive receptor is a small day care facility located approximately 1,535 feet (0.29 mile) to the north of the project boundary. The closest potentially occupied outdoor receptor would be the parking lot of the Home Depot located approximately 653 feet (0.12 mile) to the east.

According to the Caltrans Sound guidance[1] for determining project impacts, the model is validated within 500 feet and does not need further analysis unless it can be shown that there are particular special circumstances. This is simply because of normal attenuation of sound by distance.[2] The further a sound source is from the receiver, the quieter it seems.

However, there are many types of sound sources that differ in frequency(ies), relative intensity, and how they are perceived. Linear sounds, such as heavy road traffic, is less attenuated than a single point source, such as a stationary bulldozer. A sound increase of 10 dB is roughly equivalent to a doubling in the perceived sound level. For example, the loudest single piece of equipment proposed for the construction at the site is 85 dB (excavator/bulldozer @ 50 ft. nominal, which results in a 55.26 dB sound at the nearest sensitive receptor from the edge of the

[1] California Department of Transportation, Traffic Noise Analysis Protocol pg .12
[2] http://www.bksv.com/library/dictionary.aspx?key=s

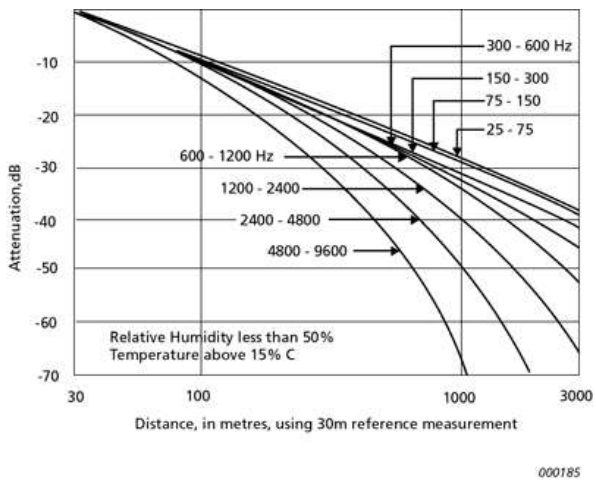
property of the nearest sensitive receptor to the nearest edge of the project footprint, equivalent to roughly 12.5% of the perceived sound level.[3]

For this analysis, factors such as the sound absorbency or reflectivity of the ground were not considered because the direct sound path to the nearest sensitive receptor is soft ground, grasses, and low shrubs that absorb sound. Therefore, the estimates without ground considerations are conservative toward protecting sensitive receptors.

BACKGROUND

There are several common terms and abbreviations used in sound studies:

- L50 - The sound level is exceeded 50 percent of the time. This level corresponds to the median sound level.
- L90 - The sound level is exceeded 90 percent of the time. This is a measure of the nominal background level. For example:



METHODS

A Type 1 meter was used for the study: a Larsen Davis Model 831 (SN 0002664), Firmware 2.201 PRM 831 Pre-amp, PCB brand PRM831 01098, Microphone PCB 377B02 (SN LW135537) using Larsen Davis windscreen Model WS001. The meter was calibrated using a Larsen Davis Model CAL200 (SN8164) Sound Level Calibrator (NIST) at room temperature, near sea-level 1Khz 94 db Cal. EAD 5/22/13, acoustical calibrator used before and after testing. All noise level measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA).

[3] Roadway Construction Noise Model Users Guide, 2006; pg. 3

The Type 1 precision sound level meter was programmed in "slow" mode to record noise levels in "A" weighted form as well as the frequency spectrum of the noise broken down into 1/3 octaves. The sound level meter and microphone were mounted on a stabilized tripod, 5 feet above the ground and were equipped with a windscreen during all measurements.

RESULTS

This sound study provides a baseline for existing sound conditions at the project and at the nearest sensitive receptor. A verification of the expected sound from construction was made, and the distances from the closest possible equipment sources, the project boundary and the sensitive receptor was field verified (Figure 3.10-1). The site-specific data (Figure 3.10-2) is presented in Table 1, Ambient Noise Levels.

TABLE 1
AMBIENT NOISE LEVELS

Location	Hourly Equivalent (Leq dBA)	Maximum Sound Level (Lmax dBA)	Minimum Sound Level (Lmin dBA)
001	63.2	77.8	41.5
002	59.1	79.2	40.3
003	53.0	74.0	46.0
004	50.8	59.3	45.6
005	49.8	55.3	44.7
006	44.4	55.6	38.9
007	57.5	73.4	34.8
008	43.5	56.7	34.6

BSK Associates, 2013; Field Data from 05/30/2013. Appendix 3.10

A short-term exercise was completed in the centroid of an active local mall in Rancho Cordova, of similar size and geometry, but lacking a movie theater. The study was completed on June 3, 2013 under similar temperature and humidity conditions as the Delano study. The results were consistent among three runs, L_{eq} 59.1 dB and (Day) and L_{max} 68.6 dB, and similar to the pre-project conditions at the Delano site.

The Federal Highway Administration "Roadway Construction Noise Model version 1.0"(RCNM) and the "Traffic Noise Model version 2.5" (TNM) was utilized to determine the sound levels for this project. The RCNM calculated the predicted L_{max} dBA for construction of the project. This model calculates noise levels from construction equipment with known noise outputs relative to a sensitive receiver. The TNM model calculated the L_{dn} dBA sounds levels for "Existing Plus Project Conditions" and "Cumulative Plus Project Conditions". These conditions were based on the transportation impact analysis report (TIAR) completed by Omni Means (2014)[4]. This model also calculated L_{dn} sounds levels to the nearest sensitive receiver. The receiver used in both models for the Existing Plus Project is a day care located approximately 0.29 miles from the project site boundary. The Cumulative Plus Project scenario receiver is a future residential development located approximately 175 feet (0.03 mile) north of the northern project boundary. RCNM did not use this receiver since the residential development would not exist during construction of the proposed project.

Construction-related noise is not discussed in the City of Delano General Plan or the City's municipal code. However, the construction model outputs relative to the sensitive receiver are similar to the ambient noise level. The results are as follows:

[4] Grapevine Commercial Transportation Impact Analysis Report, 2014

Table 2. Calculated Construction Noise		
	Calculated (dBA)	
Equipment	*Lmax	Leq
Compressor (air)	47.9	44
Crane	50.8	42.9
Excavator	51	47
Generator (<25KVA, VMS signs)	43.1	40.1
Grader	55.3	51.3
Dozer	51.9	48
Scraper	53.9	49.9
Tractor	54.3	50.3
Front End Loader	49.4	45.4
Backhoe	47.8	43.9
Welder / Torch	44.3	40.3
Total	55.3	57.6

The total noise levels of this report are for all equipment in use simultaneously. The proposed project at most will only have two to three pieces of equipment in use at any given time and will not operate during sensitive noise hours, 10pm-7am. Furthermore, compared to the average of Table 1's L_{eq} levels (52.6 dBA), the L_{eq} total for construction is less than 3 dBA greater, and the L_{max} from construction is 57.6. The L_{max} can be considered a spike in the average noise level when the loudest piece of equipment is in use. However, based on the distance from the sensitive receptor, it is not a significant impact. Based on this information, the predicted construction noise levels will not exceed the land use thresholds for commercial areas. Therefore, the proposed project construction does not require additional mitigation.

The TNM model utilized the TIAR average daily trip volumes for its analysis. This includes the percentages of personal vehicles and heavy trucks. Trucks typically have larger noise impacts compared to personal vehicles. The modeling conducted took a conservative approach and overestimated the amount of trucks the proposed project would typically experience. Similarly,

this model allows the user to input buildings more precisely using barriers rather than building rows.[5] Following a conservative approach, the heights for every building are set at 20 feet, including the movie theater. This building alone generally will be larger than 20 feet, and will reduce noise from "spilling" over the top of the building. Finally, a 5-foot wall is positioned along the northern boundary of the project site. This wall acts as a noise barrier, with an entry to allow vehicles to enter and exit from Morse Boulevard. This wall will also act to limit loading dock noise and serve as a noise barrier for any potential projects north of the proposed project.

Prior to construction, the proposed site experiences noise primarily from Highway 99 to the east of the project. The secondary source of noise is from Woollomes Avenue running along the southern boundary of the project site. Finally, the day care provides a notable amount of noise during operation. These noise levels are illustrated in Table 1 above. In its existing condition, the proposed project site's ambient noise level is similar to a shopping center. This characteristic is shown in both Table 1 above and Table 2 below. Furthermore, the proposed projects noise will be transportation-related noise and therefore must adhere to the City of Delano's General Plan Table 7-2, which limits noise to outdoor sensitive receivers at 65 dBA L_{dn}.[6]

The TNM model outputs are as follows:

TABLE 3
CALCULATED OPERATIONAL TRAFFIC NOISE
TNM 2.5 MODEL PREDICTED LDN NOISE RESULTS FOR MULTIPLE CONDITIONS

Sensitive Receiver	Day care		Future Residential Development	
	No Barrier L_{dn} dBA	Barrier L_{dn} dBA	No Barrier L_{dn} dBA	Barrier L_{dn} dBA
Existing Conditions	51.2			
Existing Plus Project Conditions	52.6	51.2		
Cumulative Plus Project Conditions	56.9	55.2	62.4	49.4

BSK Associates, 2013; Appendix 3.10

[5] Federal Highway Administration, 1998; pg. 82
[6] City of Delano, General Plan 2005; pg. 7-8

CONCLUSION

Every condition of the proposed project falls under the 65 dBA L_{dn} threshold for transportation-related noise. Furthermore, under the City of Delano General Plan, commercial land uses can operate acceptably between 50 and 70 L_{dn} dBA.[7] The TNM model's predicted noise levels will not exceed these thresholds for the nearest sensitive receiver. Therefore, this project does not require mitigation to meet the significant thresholds illustrated in the City's general plan.

[7] City of Delano General Plan, 2005; pg. 7-5

REFERENCES

Brüel & Kjaer; Library Dictionary; (http://www.bksv.com/library/dictionary.aspx?key=s) web accessed January 2014.

California Department of Transportation, Traffic Noise Analysis Protocol; pg. 12. May, 2011; (http://www.dot.ca.gov/hq/env/noise/pub/ca_tnap_may2011.pdf) web accessed December 2013.

City of Delano, 2005. General Plan Update, adopted December 5, 2005. Pgs.

7-5 & 7-8.

Omni Means, 2014. Grapevine Commercial Transportation Impact Analysis Report, March 2014.

Roadway Construction Noise Model Users Guide, 2006; pg. 3. (http://ntl.bts.gov/lib/49000/49100/49175/rcnm.pdf) web accessed December 2013.

Attachment A

TNM 2.5 Project Related Traffic Noise Model Runs

(Existing Plus Project & Cumulative)

RESULTS: SOUND LEVELS

Grapevine Shopping Center

City of Delano
BSK Associates

21 March 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Existing Plus Project
BARRIER DESIGN: INPUT HEIGHTS

ATMOSPHERICS: 75 deg F, 52% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver												
Name	No.	#DUs	Existing Ldn	No Barrier					With Barrier			
				Ldn		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	Impact	Ldn	Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Daycare	3	1	51.2	52.6	60	1.4	10	----	51.2	1.4	0	1.4

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	1	1.4	1.4	1.4
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	1	1.4	1.4	1.4

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21 March 2014
TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Existing Plus Project

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points									
Name	Width	Name	No.	Coordinates (pavement)			Flow Control			Segment	
				X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Stradley-Belmont(EB)	12.0	point23	23	0.0	-6.0	0.00	Stop	0.00	100	Average	
		point24	24	950.0	-6.0	0.00					
Belmont-PDW(EB)	12.0	point25	25	975.0	-6.0	0.00	Stop	0.00	100	Average	
		point26	26	1,700.0	-6.0	0.00					
PDW-Dover(EB)	12.0	point27	27	1,724.0	-6.0	0.00	Signal	0.00	100	Average	
		point28	28	2,610.0	-6.0	0.00					
Dover-HDW(EB)	12.0	point29	29	2,634.0	-6.0	0.00	Signal	0.00	100	Average	
		point30	30	3,054.0	-6.0	0.00					
HDW-Dover	12.0	point48	48	3,054.0	6.0	0.00	Signal	0.00	100	Average	
		point49	49	2,634.0	6.0	0.00					
Dover-PDW	12.0	point50	50	2,610.0	6.0	0.00	Signal	0.00	100	Average	
		point51	51	1,724.0	6.0	0.00					
PDW-Belmont	12.0	point52	52	1,700.0	6.0	0.00	Signal	0.00	100	Average	
		point53	53	975.0	6.0	0.00					
Belmont-Stradley	12.0	point54	54	950.0	6.0	0.00	Stop	0.00	100	Average	
		point55	55	0.0	6.0	0.00					
Dover SB	12.0	point64	64	2,616.0	1,294.0	0.00	Stop	0.00	100	Average	
		point65	65	2,616.0	6.0	0.00					
Dover NB	12.0	point66	66	2,628.0	6.0	0.00	Signal	0.00	100	Average	
		point67	67	2,628.0	1,294.0	0.00					
Morse(EB)	12.0	point118	118	1,353.0	1,305.0	0.00	Stop	0.00	100	Average	
		point119	119	1,579.0	1,305.0	0.00					
Morse(WB)	12.0	point120	120	2,611.0	1,317.0	0.00	Stop	0.00	100	Average	
		point121	121	1,603.0	1,317.0	0.00					
Project Driveway NB	12.0	point122	122	1,718.0	6.0	0.00	Signal	0.00	100	Average	

INPUT: ROADWAYS

Grapevine Shopping Center

		point123	123	1,718.0	100.0	0.00					
Project Driveway (SB)	12.0	point124	124	1,706.0	100.0	0.00				Average	
		point125	125	1,706.0	6.0	0.00					
Dover(AboveMorseRoad)NB	12.0	point126	126	2,628.0	1,323.0	0.00	Stop	0.00	100	Average	
		point127	127	2,628.0	1,423.0	0.00					
Dover(AboveMorseRoad)SB	12.0	point128	128	2,616.0	1,423.0	0.00				Average	
		point129	129	2,616.0	1,323.0	0.00					
Belmont(AboveMorse)NB	12.0	point130	130	1,353.0	1,323.0	0.00				Average	
		point131	131	1,353.0	1,423.0	0.00					
Belmont(AboveMorse)SB	12.0	point132	132	1,341.0	1,423.0	0.00				Average	
		point133	133	1,341.0	1,323.0	0.00					
Woollomes(HDE-HDW)WB	12.0	point134	134	3,716.0	6.0	0.00	Signal	0.00	100	Average	
		point135	135	3,078.0	6.0	0.00					
Woollomes(HDW-HDE)EB	12.0	point136	136	3,078.0	-6.0	0.00	Signal	0.00	100	Average	
		point137	137	3,716.0	-6.0	0.00					
Belmont(SB)	12.0	point138	138	1,341.0	1,294.0	0.00				Average	
		point139	139	1,341.0	1,223.0	0.00				Average	
		point140	140	957.0	438.0	0.00				Average	
		point141	141	957.0	6.0	0.00					
Belmont (NB)	12.0	point142	142	969.0	6.0	0.00				Average	
		point143	143	969.0	438.0	0.00				Average	
		point144	144	1,353.0	1,223.0	0.00				Average	
		point145	145	1,353.0	1,294.0	0.00					
Morse(Belmont Side)WB	12.0	point146	146	1,579.0	1,317.0	0.00				Average	
		point147	147	1,353.0	1,317.0	0.00					
Morse(Dover Side) EB	12.0	point148	148	1,603.0	1,305.0	0.00				Average	
		point149	149	2,611.0	1,305.0	0.00					

City of Delano
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21 March 2014
TNM 2.5

INPUT: TRAFFIC FOR Ldn
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Existing Plus Project

Roadway	Points																		
Name	Name	No.	Segment																
			ADT	Autos			MTrucks			HTrucks			Buses			Motorcycles		
				%D	%N	S	%D	%N	S	%D	%N	S	%D	%N	S	%D	%N	S
			veh/24hrs	%	%	mph	%	%	mph	%	%	mph	%	%	mph	%	%	mph
Stradley-Belmont(EB)	point23	23	2195	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point24	24																
Belmont-PDW(EB)	point25	25	2416	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point26	26																
PDW-Dover(EB)	point27	27	7124	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point28	28																
Dover-HDW(EB)	point29	29	10189	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point30	30																
HDW-Dover	point48	48	10189	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point49	49																
Dover-PDW	point50	50	7124	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point51	51																
PDW-Belmont	point52	52	2416	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point53	53																
Belmont-Stradley	point54	54	2195	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point55	55																
Dover SB	point64	64	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point65	65																
Dover NB	point66	66	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point67	67																
Morse(EB)	point118	118	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point119	119																
Morse(WB)	point120	120	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0

INPUT: TRAFFIC FOR Ldn **Grapevine Shopping Center**

	point121	121																
Project Driveway NB	point122	122	0	91	91	5	0	0	0	9	9	5	0	0	0	0	0	0
	point123	123																
Project Driveway (SB)	point124	124	0	91	91	5	0	0	0	9	9	5	0	0	0	0	0	0
	point125	125																
Dover(AboveMorseRoad)NB	point126	126	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point127	127																
Dover(AboveMorseRoad)SB	point128	128	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point129	129																
Belmont(AboveMorse)NB	point130	130	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point131	131																
Belmont(AboveMorse)SB	point132	132	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point133	133																
Woollomes(HDE-HDW)WB	point134	134	10189	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point135	135																
Woollomes(HDW-HDE)EB	point136	136	10189	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point137	137																
Belmont(SB)	point138	138	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point139	139	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point140	140	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point141	141																
Belmont (NB)	point142	142	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point143	143	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point144	144	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point145	145																
Morse(Belmont Side)WB	point146	146	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point147	147																
Morse(Dover Side) EB	point148	148	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point149	149																

City of Delano
BSK Associates

21 March 2014
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Existing Plus Project

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria: Existing Ldn	Impact Criteria Ldn	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Daycare	3	1	2,500.0	2,640.0	0.00	4.92	51.20	60	10.0	0.0	Y

City of Delano 21 March 2014
BSK Associates TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Existing Plus Project

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per Unit Area	$ per Unit Vol.	Top Width	Run:Rise	$ per Unit Length			X	Y	Z	at Point	Seg Ht Incre-ment	Perturbs #Up	#Dn	On Struct?	Important Reflec-tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Wall west	W	0.00	99.99	0.00				0.00	point3	3	1,358.0	1,295.0	0.00	5.00	1.00	3	3	Y	
									point4	4	1,575.0	1,295.0	0.00	5.00					
Wall East	W	0.00	99.99	0.00				0.00	point5	5	1,607.0	1,295.0	0.00	5.00	1.00	3	3	Y	
									point6	6	2,604.0	1,295.0	0.00	5.00					
Pad1	W	0.00	99.99	0.00				0.00	point22	22	1,100.0	50.0	0.00	20.00	0.00	0	0		
									point23	23	1,100.0	150.0	0.00	20.00	0.00	0	0		
									point24	24	1,180.0	150.0	0.00	20.00	0.00	0	0		
									point25	25	1,180.0	50.0	0.00	20.00	0.00	0	0		
									point26	26	1,100.0	50.0	0.00	20.00					
Pad2	W	0.00	99.99	0.00				0.00	point28	28	1,300.0	60.0	0.00	20.00	0.00	0	0		
									point29	29	1,300.0	123.0	0.00	20.00	0.00	0	0		
									point30	30	1,340.0	123.0	0.00	20.00	0.00	0	0		
									point31	31	1,340.0	60.0	0.00	20.00	0.00	0	0		
									point32	32	1,300.0	60.0	0.00	20.00					
Pad 3	W	0.00	99.99	0.00				0.00	point33	33	1,500.0	123.0	0.00	20.00	1.00	0	0		
									point34	34	1,500.0	60.0	0.00	20.00	1.00	0	0		
									point35	35	1,540.0	60.0	0.00	20.00	1.00	0	0		
									point36	36	1,540.0	123.0	0.00	20.00	1.00	0	0		
									point37	37	1,500.0	123.0	0.00	20.00					
Pad 8	W	0.00	99.99	0.00				0.00	point38	38	2,160.0	123.0	0.00	20.00	1.00	0	0		
									point39	39	2,160.0	60.0	0.00	20.00	1.00	0	0		
									point40	40	2,200.0	60.0	0.00	20.00	1.00	0	0		
									point41	41	2,200.0	123.0	0.00	20.00	1.00	0	0		
									point42	42	2,160.0	123.0	0.00	20.00					
Pad9	W	0.00	99.99	0.00				0.00	point43	43	2,400.0	60.0	0.00	20.00	1.00	0	0		
									point44	44	2,400.0	123.0	0.00	20.00	1.00	0	0		
									point45	45	2,440.0	123.0	0.00	20.00	1.00	0	0		
									point46	46	2,440.0	60.0	0.00	20.00	1.00	0	0		
									point47	47	2,400.0	60.0	0.00	20.00					
Pad 7	W	0.00	99.99	0.00				0.00	point48	48	1,900.0	120.0	0.00	20.00	1.00	0	0		
									point49	49	1,900.0	40.0	0.00	20.00	1.00	0	0		
									point50	50	2,000.0	40.0	0.00	20.00	1.00	0	0		
									point51	51	2,000.0	120.0	0.00	20.00	1.00	0	0		
									point52	52	1,900.0	120.0	0.00	20.00					
Pad 6	W	0.00	99.99	0.00				0.00	point53	53	1,790.0	211.0	0.00	20.00	1.00	0	0		

INPUT: BARRIERS

Grapevine Shopping Center

									point54	54	1,790.0	132.5	0.00	20.00	1.00	0	0		
									point55	55	1,860.0	132.5	0.00	20.00	1.00	0	0		
									point56	56	1,860.0	211.0	0.00	20.00	1.00	0	0		
									point57	57	1,790.0	211.0	0.00	20.00					
Shops C	W	0.00	99.99	0.00				0.00	point64	64	2,490.1	177.4	0.00	20.00	1.00	0	0		
									point65	65	2,386.6	177.4	0.00	20.00	1.00	0	0		
									point66	66	2,386.6	346.5	0.00	20.00	1.00	0	0		
									point67	67	2,338.2	346.5	0.00	20.00	1.00	0	0		
									point68	68	2,338.2	436.2	0.00	20.00	1.00	0	0		
									point69	69	2,490.1	436.2	0.00	20.00	1.00	0	0		
									point70	70	2,490.1	177.4	0.00	20.00					
Pad 4	W	0.00	99.99	0.00				0.00	point71	71	1,389.0	242.9	0.00	20.00	1.00	0	0		
									point72	72	1,506.4	242.9	0.00	20.00	1.00	0	0		
									point73	73	1,506.4	298.2	0.00	20.00	1.00	0	0		
									point74	74	1,482.2	322.3	0.00	20.00	1.00	0	0		
									point75	75	1,389.0	322.3	0.00	20.00	1.00	0	0		
									point76	76	1,389.0	242.9	0.00	20.00					
Pad 5	W	0.00	99.99	0.00				0.00	point77	77	1,530.5	318.9	0.00	20.00	1.00	0	0		
									point78	78	1,606.5	318.9	0.00	20.00	1.00	0	0		
									point79	79	1,606.5	425.9	0.00	20.00	1.00	0	0		
									point80	80	1,509.8	425.9	0.00	20.00	1.00	0	0		
									point81	81	1,509.8	343.0	0.00	20.00	1.00	0	0		
									point82	82	1,530.5	318.9	0.00	20.00					
Shops G	W	0.00	99.99	0.00				0.00	point94	94	2,037.9	755.0	0.00	20.00	1.00	0	0		
									point95	95	2,165.6	755.0	0.00	20.00	1.00	0	0		
									point96	96	2,165.6	695.1	0.00	20.00	1.00	0	0		
									point97	97	2,082.8	695.1	0.00	20.00	1.00	0	0		
									point98	98	2,134.6	595.0	0.00	20.00	1.00	0	0		
									point99	99	2,172.6	595.0	0.00	20.00	1.00	0	0		
									point100	100	2,172.6	543.2	0.00	20.00	1.00	0	0		
									point101	101	2,093.2	543.2	0.00	20.00	1.00	0	0		
									point102	102	2,037.9	640.0	0.00	20.00	1.00	0	0		
									point103	103	2,037.9	755.0	0.00	20.00					
Shops D	W	0.00	99.99	0.00				0.00	point105	105	1,886.1	819.4	0.00	20.00	1.00	0	0		
									point106	106	2,003.4	819.4	0.00	20.00	1.00	0	0		
									point107	107	2,003.4	981.6	0.00	20.00	1.00	0	0		
									point108	108	1,962.0	1,016.1	0.00	20.00	1.00	0	0		
									point109	109	1,886.1	1,016.1	0.00	20.00	1.00	0	0		
									point110	110	1,886.1	819.4	0.00	20.00					
Shops E	W	0.00	99.99	0.00				0.00	point111	111	2,031.0	819.4	0.00	20.00	1.00	0	0		
									point112	112	2,162.2	819.4	0.00	20.00	1.00	0	0		
									point113	113	2,162.2	1,016.1	0.00	20.00	1.00	0	0		
									point114	114	2,069.0	1,016.1	0.00	20.00	1.00	0	0		
									point115	115	2,031.0	978.1	0.00	20.00	1.00	0	0		
									point116	116	2,031.0	819.4	0.00	20.00					
Anchor 2 Major 1, etc	W	0.00	99.99	0.00				0.00	point117	117	1,423.5	1,109.3	0.00	20.00	1.00	0	0		
									point118	118	2,107.0	1,109.3	0.00	20.00	1.00	0	0		
									point119	119	2,107.0	1,264.6	0.00	20.00	1.00	0	0		

INPUT: BARRIERS

Grapevine Shopping Center

									point120	120	1,423.5	1,264.6	0.00	20.00	1.00	0	0			
									point121	121	1,423.5	1,109.3	0.00	20.00						
Cinemark	W	0.00	99.99	0.00				0.00	point122	122	2,250.0	1,250.0	0.00	20.00	1.00	0	0			
									point123	123	2,250.0	1,120.0	0.00	20.00	1.00	0	0			
									point124	124	2,515.0	1,120.0	0.00	20.00	1.00	0	0			
									point125	125	2,515.0	1,250.0	0.00	20.00	1.00	0	0			
									point126	126	2,250.0	1,250.0	0.00	20.00						
Major 5 etc	W	0.00	99.99	0.00				0.00	point127	127	1,063.7	314.5	0.00	20.00	1.00	0	0			
									point128	128	1,204.2	314.5	0.00	20.00	1.00	0	0			
									point129	129	1,264.8	560.4	0.00	20.00	1.00	0	0			
									point130	130	1,242.5	598.7	0.00	20.00	1.00	0	0			
									point131	131	1,111.6	624.2	0.00	20.00	1.00	0	0			
									point132	132	1,070.1	512.5	0.00	20.00	1.00	0	0			
									point133	133	1,092.4	506.1	0.00	20.00	1.00	0	0			
									point134	134	1,066.9	419.9	0.00	20.00	1.00	0	0			
									point135	135	1,089.2	410.3	0.00	20.00	1.00	0	0			
									point136	136	1,054.1	368.8	0.00	20.00	1.00	0	0			
									point137	137	1,060.5	317.7	0.00	20.00						
Shops F	W	0.00	99.99	0.00				0.00	point138	138	1,930.0	595.0	0.00	20.00	1.00	0	0			
									point139	139	1,879.2	595.0	0.00	20.00	1.00	0	0			
									point140	140	1,879.2	543.2	0.00	20.00	1.00	0	0			
									point141	141	1,965.5	543.2	0.00	20.00	1.00	0	0			
									point142	142	2,010.3	640.0	0.00	20.00	1.00	0	0			
									point143	143	2,010.3	757.2	0.00	20.00	1.00	0	0			
									point144	144	1,886.1	757.2	0.00	20.00	1.00	0	0			
									point145	145	1,886.1	695.1	0.00	20.00	1.00	0	0			
									point146	146	1,960.0	695.1	0.00	20.00	1.00	0	0			
									point147	147	1,930.0	595.0	0.00	20.00						
Pad1 Barrier instead of building per TNM users guide pg. 82																				

City of Delano
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TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Cumulative Project
BARRIER DESIGN: INPUT HEIGHTS

ATMOSPHERICS: 75 deg F, 52% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing Ldn	No Barrier Ldn Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated Ldn	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Daycare	3	1	51.2	56.9	60	5.7	10	----	55.2	1.7	0	1.7
Future Housing Development	13	1	50.9	62.4	60	11.5	10	Both	49.4	13.0	0	13.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	2	1.7	7.4	13.0
All Impacted	1	13.0	13.0	13.0
All that meet NR Goal	2	1.7	7.4	13.0

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INPUT: ROADWAYS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Cumulative Project

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points									
Name	Width	Name	No.	Coordinates (pavement)			Flow Control			Segment	
				X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Stradley-Belmont(EB)	24.0	point23	23	0.0	-6.0	0.00	Signal	0.00	100	Average	
		point24	24	950.0	-6.0	0.00					
Belmont-PDW(EB)	24.0	point25	25	975.0	-6.0	0.00	Signal	0.00	100	Average	
		point26	26	1,700.0	-6.0	0.00					
PDW-Dover(EB)	48.0	point27	27	1,724.0	-6.0	0.00	Signal	0.00	100	Average	
		point28	28	2,610.0	-6.0	0.00					
Dover-HDW(EB)	48.0	point29	29	2,634.0	-6.0	0.00	Signal	0.00	100	Average	
		point30	30	3,054.0	-6.0	0.00					
HDW-Dover	48.0	point48	48	3,054.0	6.0	0.00	Signal	0.00	100	Average	
		point49	49	2,634.0	6.0	0.00					
Dover-PDW	48.0	point50	50	2,610.0	6.0	0.00	Signal	0.00	100	Average	
		point51	51	1,724.0	6.0	0.00					
PDW-Belmont	24.0	point52	52	1,700.0	6.0	0.00	Signal	0.00	100	Average	
		point53	53	975.0	6.0	0.00					
Belmont-Stradley	24.0	point54	54	950.0	6.0	0.00	Signal	0.00	100	Average	
		point55	55	0.0	6.0	0.00					
Dover SB	36.0	point64	64	2,616.0	1,294.0	0.00	Stop	0.00	100	Average	
		point65	65	2,616.0	6.0	0.00					
Dover NB	36.0	point66	66	2,628.0	6.0	0.00	Signal	0.00	100	Average	
		point67	67	2,628.0	1,294.0	0.00					
Morse(EB)	12.0	point118	118	1,353.0	1,305.0	0.00	Stop	0.00	100	Average	
		point119	119	1,579.0	1,305.0	0.00					
Morse(WB)	12.0	point120	120	2,611.0	1,317.0	0.00	Stop	0.00	100	Average	
		point121	121	1,603.0	1,317.0	0.00					
Project Driveway NB	24.0	point122	122	1,718.0	6.0	0.00	Signal	0.00	100	Average	

INPUT: ROADWAYS

Grapevine Shopping Center

		point123	123	1,718.0	100.0	0.00					
Project Driveway (SB)	24.0	point124	124	1,706.0	100.0	0.00				Average	
		point125	125	1,706.0	6.0	0.00					
Dover(AboveMorse)NB	24.0	point126	126	2,628.0	1,323.0	0.00	Stop	0.00	100	Average	
		point127	127	2,628.0	1,423.0	0.00					
Dover(AboveMorse)SB	24.0	point128	128	2,616.0	1,423.0	0.00				Average	
		point129	129	2,616.0	1,323.0	0.00					
Belmont(AboveMorse)NB	12.0	point130	130	1,353.0	1,323.0	0.00	Stop	0.00	100	Average	
		point131	131	1,353.0	1,423.0	0.00					
Belmont(AboveMorse)SB	12.0	point132	132	1,341.0	1,423.0	0.00				Average	
		point133	133	1,341.0	1,323.0	0.00					
Woollomes(HDE-HDW)WB	48.0	point134	134	3,716.0	6.0	0.00	Signal	0.00	100	Average	
		point135	135	3,078.0	6.0	0.00					
Woollomes(HDW-HDE)EB	48.0	point136	136	3,078.0	-6.0	0.00	Signal	0.00	100	Average	
		point137	137	3,716.0	-6.0	0.00					
Belmont(SB)	12.0	point138	138	1,341.0	1,294.0	0.00				Average	
		point139	139	1,341.0	1,223.0	0.00				Average	
		point140	140	957.0	438.0	0.00				Average	
		point141	141	957.0	6.0	0.00					
Belmont (NB)	12.0	point142	142	969.0	6.0	0.00				Average	
		point143	143	969.0	438.0	0.00				Average	
		point144	144	1,353.0	1,223.0	0.00				Average	
		point145	145	1,353.0	1,294.0	0.00					
Morse(Belmont Side)WB	12.0	point146	146	1,579.0	1,317.0	0.00				Average	
		point147	147	1,353.0	1,317.0	0.00					
Morse(Dover Side) EB	12.0	point148	148	1,603.0	1,305.0	0.00				Average	
		point149	149	2,611.0	1,305.0	0.00					

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INPUT: TRAFFIC FOR Ldn
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Cumulative Project

Roadway	Points																		
Name	Name	No.	Segment																
			ADT	Autos			MTrucks			HTrucks			Buses			Motorcycles		
				%D	%N	S	%D	%N	S	%D	%N	S	%D	%N	S	%D	%N	S
			veh/24hrs	%	%	mph	%	%	mph	%	%	mph	%	%	mph	%	%	mph
Stradley-Belmont(EB)	point23	23	12663	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point24	24																
Belmont-PDW(EB)	point25	25	12884	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point26	26																
PDW-Dover(EB)	point27	27	17592	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point28	28																
Dover-HDW(EB)	point29	29	24957	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point30	30																
HDW-Dover	point48	48	24957	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point49	49																
Dover-PDW	point50	50	17592	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point51	51																
PDW-Belmont	point52	52	12884	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point53	53																
Belmont-Stradley	point54	54	12663	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point55	55																
Dover SB	point64	64	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point65	65																
Dover NB	point66	66	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point67	67																
Morse(EB)	point118	118	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point119	119																
Morse(WB)	point120	120	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0

INPUT: TRAFFIC FOR Ldn **Grapevine Shopping Center**

	point121	121																
Project Driveway NB	point122	122	0	91	91	5	0	0	0	9	9	5	0	0	0	0	0	0
	point123	123																
Project Driveway (SB)	point124	124	0	91	91	5	0	0	0	9	9	5	0	0	0	0	0	0
	point125	125																
Dover(AboveMorse)NB	point126	126	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point127	127																
Dover(AboveMorse)SB	point128	128	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point129	129																
Belmont(AboveMorse)NB	point130	130	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point131	131																
Belmont(AboveMorse)SB	point132	132	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point133	133																
Woollomes(HDE-HDW)WB	point134	134	24957	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point135	135																
Woollomes(HDW-HDE)EB	point136	136	24957	91	91	45	0	0	0	9	9	45	0	0	0	0	0	0
	point137	137																
Belmont(SB)	point138	138	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point139	139	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point140	140	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point141	141																
Belmont (NB)	point142	142	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point143	143	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point144	144	221	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point145	145																
Morse(Belmont Side)WB	point146	146	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point147	147																
Morse(Dover Side) EB	point148	148	0	91	91	35	0	0	0	9	9	35	0	0	0	0	0	0
	point149	149																

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INPUT: RECEIVERS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Cumulative Project

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria Existing Ldn	Impact Criteria Ldn	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Daycare	3	1	2,500.0	2,640.0	0.00	4.92	51.20	60	10.0	0.0	Y
Future Housing Development	13	1	1,816.9	1,361.0	0.00	4.92	50.90	60	10.0	0.0	Y

City of Delano 21 March 2014
BSK Associates TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: Grapevine Shopping Center
RUN: Cumulative Project

Barrier Name	Type	Height Min	Height Max	If Wall $ per Unit Area	If Berm $ per Unit Vol.	Top Width	Run:Rise	Add'tnl $ per Unit Length	Points Name	No.	Coordinates (bottom) X	Y	Z	Height at Point	Segment Seg Ht Increment	Perturbs #Up	#Dn	On Struct?	Important Reflections?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Wall west	W	0.00	99.99	0.00				0.00	point3	3	1,358.0	1,295.0	0.00	5.00	1.00	3	3	Y	
									point4	4	1,575.0	1,295.0	0.00	5.00					
Wall East	W	0.00	99.99	0.00				0.00	point5	5	1,607.0	1,295.0	0.00	5.00	1.00	3	3	Y	
									point6	6	2,604.0	1,295.0	0.00	5.00					
Pad1	W	0.00	99.99	0.00				0.00	point22	22	1,100.0	50.0	0.00	20.00	0.00	0	0		
									point23	23	1,100.0	150.0	0.00	20.00	0.00	0	0		
									point24	24	1,180.0	150.0	0.00	20.00	0.00	0	0		
									point25	25	1,180.0	50.0	0.00	20.00	0.00	0	0		
									point26	26	1,100.0	50.0	0.00	20.00					
Pad2	W	0.00	99.99	0.00				0.00	point28	28	1,300.0	60.0	0.00	20.00	0.00	0	0		
									point29	29	1,300.0	123.0	0.00	20.00	0.00	0	0		
									point30	30	1,340.0	123.0	0.00	20.00	0.00	0	0		
									point31	31	1,340.0	60.0	0.00	20.00	0.00	0	0		
									point32	32	1,300.0	60.0	0.00	20.00					
Pad 3	W	0.00	99.99	0.00				0.00	point33	33	1,500.0	123.0	0.00	20.00	1.00	0	0		
									point34	34	1,500.0	60.0	0.00	20.00	1.00	0	0		
									point35	35	1,540.0	60.0	0.00	20.00	1.00	0	0		
									point36	36	1,540.0	123.0	0.00	20.00	1.00	0	0		
									point37	37	1,500.0	123.0	0.00	20.00					
Pad 8	W	0.00	99.99	0.00				0.00	point38	38	2,160.0	123.0	0.00	20.00	1.00	0	0		
									point39	39	2,160.0	60.0	0.00	20.00	1.00	0	0		
									point40	40	2,200.0	60.0	0.00	20.00	1.00	0	0		
									point41	41	2,200.0	123.0	0.00	20.00	1.00	0	0		
									point42	42	2,160.0	123.0	0.00	20.00					
Pad9	W	0.00	99.99	0.00				0.00	point43	43	2,400.0	60.0	0.00	20.00	1.00	0	0		
									point44	44	2,400.0	123.0	0.00	20.00	1.00	0	0		
									point45	45	2,440.0	123.0	0.00	20.00	1.00	0	0		
									point46	46	2,440.0	60.0	0.00	20.00	1.00	0	0		
									point47	47	2,400.0	60.0	0.00	20.00					
Pad 7	W	0.00	99.99	0.00				0.00	point48	48	1,900.0	120.0	0.00	20.00	1.00	0	0		
									point49	49	1,900.0	40.0	0.00	20.00	1.00	0	0		
									point50	50	2,000.0	40.0	0.00	20.00	1.00	0	0		
									point51	51	2,000.0	120.0	0.00	20.00	1.00	0	0		
									point52	52	1,900.0	120.0	0.00	20.00					
Pad 6	W	0.00	99.99	0.00				0.00	point53	53	1,790.0	211.0	0.00	20.00	1.00	0	0		

INPUT: BARRIERS

Grapevine Shopping Center

									point54	54	1,790.0	132.5	0.00	20.00	1.00	0	0		
									point55	55	1,860.0	132.5	0.00	20.00	1.00	0	0		
									point56	56	1,860.0	211.0	0.00	20.00	1.00	0	0		
									point57	57	1,790.0	211.0	0.00	20.00					
Shops C	W	0.00	99.99	0.00				0.00	point64	64	2,490.1	177.4	0.00	20.00	1.00	0	0		
									point65	65	2,386.6	177.4	0.00	20.00	1.00	0	0		
									point66	66	2,386.6	346.5	0.00	20.00	1.00	0	0		
									point67	67	2,338.2	346.5	0.00	20.00	1.00	0	0		
									point68	68	2,338.2	436.2	0.00	20.00	1.00	0	0		
									point69	69	2,490.1	436.2	0.00	20.00	1.00	0	0		
									point70	70	2,490.1	177.4	0.00	20.00					
Pad 4	W	0.00	99.99	0.00				0.00	point71	71	1,389.0	242.9	0.00	20.00	1.00	0	0		
									point72	72	1,506.4	242.9	0.00	20.00	1.00	0	0		
									point73	73	1,506.4	298.2	0.00	20.00	1.00	0	0		
									point74	74	1,482.2	322.3	0.00	20.00	1.00	0	0		
									point75	75	1,389.0	322.3	0.00	20.00	1.00	0	0		
									point76	76	1,389.0	242.9	0.00	20.00					
Pad 5	W	0.00	99.99	0.00				0.00	point77	77	1,530.5	318.9	0.00	20.00	1.00	0	0		
									point78	78	1,606.5	318.9	0.00	20.00	1.00	0	0		
									point79	79	1,606.5	425.9	0.00	20.00	1.00	0	0		
									point80	80	1,509.8	425.9	0.00	20.00	1.00	0	0		
									point81	81	1,509.8	343.0	0.00	20.00	1.00	0	0		
									point82	82	1,530.5	318.9	0.00	20.00					
Shops G	W	0.00	99.99	0.00				0.00	point94	94	2,037.9	755.0	0.00	20.00	1.00	0	0		
									point95	95	2,165.6	755.0	0.00	20.00	1.00	0	0		
									point96	96	2,165.6	695.1	0.00	20.00	1.00	0	0		
									point97	97	2,082.8	695.1	0.00	20.00	1.00	0	0		
									point98	98	2,134.6	595.0	0.00	20.00	1.00	0	0		
									point99	99	2,172.6	595.0	0.00	20.00	1.00	0	0		
									point100	100	2,172.6	543.2	0.00	20.00	1.00	0	0		
									point101	101	2,093.2	543.2	0.00	20.00	1.00	0	0		
									point102	102	2,037.9	640.0	0.00	20.00	1.00	0	0		
									point103	103	2,037.9	755.0	0.00	20.00					
Shops D	W	0.00	99.99	0.00				0.00	point105	105	1,886.1	819.4	0.00	20.00	1.00	0	0		
									point106	106	2,003.4	819.4	0.00	20.00	1.00	0	0		
									point107	107	2,003.4	981.6	0.00	20.00	1.00	0	0		
									point108	108	1,962.0	1,016.1	0.00	20.00	1.00	0	0		
									point109	109	1,886.1	1,016.1	0.00	20.00	1.00	0	0		
									point110	110	1,886.1	819.4	0.00	20.00					
Shops E	W	0.00	99.99	0.00				0.00	point111	111	2,031.0	819.4	0.00	20.00	1.00	0	0		
									point112	112	2,162.2	819.4	0.00	20.00	1.00	0	0		
									point113	113	2,162.2	1,016.1	0.00	20.00	1.00	0	0		
									point114	114	2,069.0	1,016.1	0.00	20.00	1.00	0	0		
									point115	115	2,031.0	978.1	0.00	20.00	1.00	0	0		
									point116	116	2,031.0	819.4	0.00	20.00					
Anchor 2 Major 1, etc	W	0.00	99.99	0.00				0.00	point117	117	1,423.5	1,109.3	0.00	20.00	1.00	0	0		
									point118	118	2,107.0	1,109.3	0.00	20.00	1.00	0	0		
									point119	119	2,107.0	1,264.6	0.00	20.00	1.00	0	0		

INPUT: BARRIERS

Grapevine Shopping Center

									point120	120	1,423.5	1,264.6	0.00	20.00	1.00	0	0		
									point121	121	1,423.5	1,109.3	0.00	20.00					
Cinemark	W	0.00	99.99	0.00				0.00	point122	122	2,250.0	1,250.0	0.00	20.00	1.00	0	0		
									point123	123	2,250.0	1,120.0	0.00	20.00	1.00	0	0		
									point124	124	2,515.0	1,120.0	0.00	20.00	1.00	0	0		
									point125	125	2,515.0	1,250.0	0.00	20.00	1.00	0	0		
									point126	126	2,250.0	1,250.0	0.00	20.00					
Major 5 etc	W	0.00	99.99	0.00				0.00	point127	127	1,063.7	314.5	0.00	20.00	1.00	0	0		
									point128	128	1,204.2	314.5	0.00	20.00	1.00	0	0		
									point129	129	1,264.8	560.4	0.00	20.00	1.00	0	0		
									point130	130	1,242.5	598.7	0.00	20.00	1.00	0	0		
									point131	131	1,111.6	624.2	0.00	20.00	1.00	0	0		
									point132	132	1,070.1	512.5	0.00	20.00	1.00	0	0		
									point133	133	1,092.4	506.1	0.00	20.00	1.00	0	0		
									point134	134	1,066.9	419.9	0.00	20.00	1.00	0	0		
									point135	135	1,089.2	410.3	0.00	20.00	1.00	0	0		
									point136	136	1,054.1	368.8	0.00	20.00	1.00	0	0		
									point137	137	1,060.5	317.7	0.00	20.00					
Shops F	W	0.00	99.99	0.00				0.00	point138	138	1,930.0	595.0	0.00	20.00	1.00	0	0		
									point139	139	1,879.2	595.0	0.00	20.00	1.00	0	0		
									point140	140	1,879.2	543.2	0.00	20.00	1.00	0	0		
									point141	141	1,965.5	543.2	0.00	20.00	1.00	0	0		
									point142	142	2,010.3	640.0	0.00	20.00	1.00	0	0		
									point143	143	2,010.3	757.2	0.00	20.00	1.00	0	0		
									point144	144	1,886.1	757.2	0.00	20.00	1.00	0	0		
									point145	145	1,886.1	695.1	0.00	20.00	1.00	0	0		
									point146	146	1,960.0	695.1	0.00	20.00	1.00	0	0		
									point147	147	1,930.0	595.0	0.00	20.00					
Pad1 Barrier instead of building per TNM users guide pg. 82																			

Attachment B

Roadway Construction Noise Model Run

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 12/18/2013
Case Description: Grapevine Shopping Center

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Daycare	Residential	55	55	50

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compressor (air)	No	40		77.7	1531.2	0
Crane	No	16		80.6	1531.2	0
Excavator	No	40		80.7	1531.2	0
Generator (<25KVA, VMS signs)	No	50		72.8	1531.2	0
Grader	No	40	85		1531.2	0
Dozer	No	40		81.7	1531.2	0
Scraper	No	40		83.6	1531.2	0
Tractor	No	40	84		1531.2	0
Front End Loader	No	40		79.1	1531.2	0
Backhoe	No	40		77.6	1531.2	0
Welder / Torch	No	40		74	1531.2	0

Equipment	Calculated (dBA) *Lmax	Leq	Results Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq
Compressor (air)	47.9	44	N/A	N/A	N/A	N/A
Crane	50.8	42.9	N/A	N/A	N/A	N/A
Excavator	51	47	N/A	N/A	N/A	N/A
Generator (<25KVA, VMS signs)	43.1	40.1	N/A	N/A	N/A	N/A
Grader	55.3	51.3	N/A	N/A	N/A	N/A
Dozer	51.9	48	N/A	N/A	N/A	N/A
Scraper	53.9	49.9	N/A	N/A	N/A	N/A
Tractor	54.3	50.3	N/A	N/A	N/A	N/A
Front End Loader	49.4	45.4	N/A	N/A	N/A	N/A
Backhoe	47.8	43.9	N/A	N/A	N/A	N/A
Welder / Torch	44.3	40.3	N/A	N/A	N/A	N/A
Total	55.3	57.6	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Noise Limit Exceedance (dBA)

Night		Day		Evening		Night	
Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

APPENDIX 3.13

TRAFFIC STUDIES

BSK

Grapevine Commercial
Transportation Impact Analysis Report

Prepared for:

BSK Associates

Prepared by:

omni · means
ENGINEERS · PLANNERS

GRAPEVINE COMMERCIAL TRANSPORTATION IMPACT ANALYSIS REPORT

PREPARED FOR:
BSK ASSOCIATES
3140 GOLD CAMP DRIVE #160
RANCHO CORDOVA, CA 95670

PREPARED BY:
OMNI-MEANS, LTD.
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MARCH 2014

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APPENDIX

SYNCHRO LEVEL OF SERVICE REPORT
SIM-TRAFFIC OPERATION & QUEUING REPORTS
HCS LEVEL OF SERVICE WORKSHEETS

INTRODUCTION

This report has been prepared for BSK Associates to present the results of a Transportation Impact Analysis Report (TIAR) performed by OMNI-MEANS for the proposed *Grapevine Commercial* project in the City of Delano, California (City). The proposed retail and restaurant use project is on an approximately 44.64 acre site on the southern edge of the City on the north side of Woollomes Avenue, about ½ mile west of the Woollomes Avenue/State Route 99 (SR 99) interchange. The project location is shown in Figure 1.

The following scenarios are analyzed as a part of this report:

- *Existing* conditions
- *Existing Plus Project* conditions
- *Cumulative No Project* conditions
- *Cumulative Plus Project* conditions

The *Existing* Conditions analysis investigates current traffic operations within the study area. New traffic counts were obtained in August 2013 after construction in the project vicinity was completed, in order to realistically simulate existing traffic conditions at all study locations. Existing traffic volumes on the SR 99 mainline were obtained from the Caltrans Traffic Data Branch's *"2012 Traffic Volumes on California State Highways"*.

Existing Plus Project conditions were generated by adding traffic generated from the proposed project to existing volumes to simulate *Existing Plus Project* conditions and to quantify project impacts.

Cumulative No Project conditions project traffic operations upon build out of the City General Plan. KernCOG travel demand model outputs were compared to Kern County travel demand model outputs and traffic volumes from previous traffic studies. Kern County projections were used to simulate *Cumulative* conditions as they were more conservative and better represented existing conditions. *Cumulative Plus Project* conditions build upon *Cumulative No Project* conditions by superimposing project-generated trips as they are distributed through study locations over the projected City General Plan build out traffic volumes.

Adverse project impacts and improvements identified to mitigate project impacts will be detailed in the final section of this report.

Grapevine Commercial TIAR

Figure 1

Project Location and Vicinity Map

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EXISTING CONDITIONS

The City of Delano is an incorporated community located on the northern end of Kern County. The City is located along State Route (SR) 99 about 31 miles north of the City of Bakersfield. The City of Delano is the second most populated City in Kern County with an official population as of 2011 of 53,819. Existing intersection lane geometrics for this study are presented in Figure 2. The existing geometrics are representative of recently completed construction on Woollomes Avenue and at the SR 99 interchange.

EXISTING TRANSPORTATION SYSTEM

The following roadways provide primary circulation within the City of Delano and in the vicinity of the proposed *Grapevine Commercial* project.

State Route 99 (SR 99) is a major state freeway facility that traverses in the north-south direction through central and northern California. Regionally, SR 99 serves as the primary inter-regional auto and truck travel route that connects the Central Valley cities of Tulare, Visalia and Fresno to the north and Bakersfield, Interstate 5 and the greater Los Angeles basin to the south. Within Kern County, SR 99 serves as a vital north-south circulator, and is a general six-lane divided freeway with a 65 mph posted speed limit in the project vicinity. Improvements to the full-access Woollomes Avenue interchange are constructed.

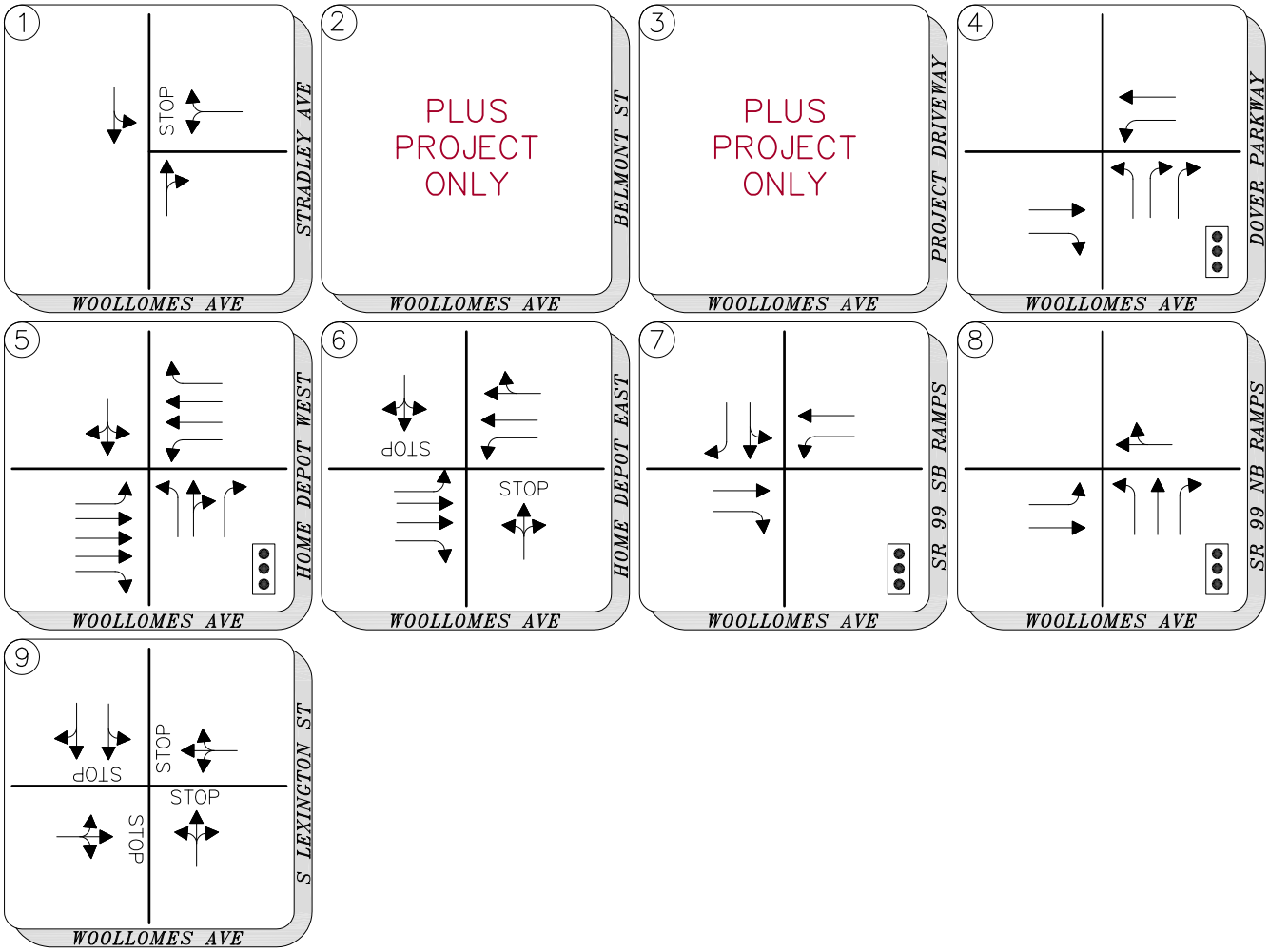
Woollomes Avenue is an east-west rural arterial on the southern end of Delano that extends from Stradley Avenue/Albany Street to Lexington Street. Woollomes Avenue is currently being improved to a 4 to 6 lane cross section between Dover Parkway and the SR 99 northbound ramp terminal, but is otherwise an undivided 2-lane rural roadway.

Stradley Avenue/Albany Street is a north-south 2-lane rural arterial connecting the City of Delano to the north to the City of McFarland to the south. Through the City of Delano, Albany Street is the principal north-south roadway on the west side of SR 99.

Dover Parkway is a north-south 2-lane residential collector that will be extended northerly to intersection Woollomes Avenue at the time the proposed project is developed. Once this connection is made, Dover Parkway will be a viable local north-south alternative to SR 99 between Woollomes Avenue and the residential areas to the north. South of Woollomes Avenue, Dover Parkway is being extended to serve the approved Delano Market Place I development and will redirect traffic to Garzoli Avenue (which previously intersected Woollomes Avenue as a SR 99 frontage road).

High Street is a north-south 2-lane arterial that extends through the City of Delano mostly on the east side of SR 99 between County Line Road to the north and Woollomes Avenue to the south. The High Street intersection with Woollomes Avenue has recently undergone reconstruction as part of the Woollomes Avenue interchange project. High Street now no longer provides southbound traffic onto Woollomes Avenue. Traffic previously using High Street to reach Woollomes Avenue will be redirected mostly to Lexington Street.

Lexington Street is a north-south 2-lane collector connecting Cecil Avenue in central Delano to Woollomes Avenue and further south to Schuster Road. Between Garces Highway (State Route 165) and Woollomes Avenue Lexington Street is a 4-lane roadway. Since the southbound traffic on High Street no longer is able to access Woollomes Avenue, southbound traffic from Delano to Woollomes Avenue originating from the east side of SR-99 is likely to use Lexington Street as the primary alternate route.



Grapevine Commercial TIAR

Figure 2

Existing Intersection Lane Geometrics and Control Types

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EXISTING TRAFFIC VOLUMES

AM, PM and weekend peak hour turning movement counts for all study intersection were collected on Tuesday August 27, 2013 for AM & PM peak hour counts. Weekend peak hour turning movement counts were collected on August 31, 2013.

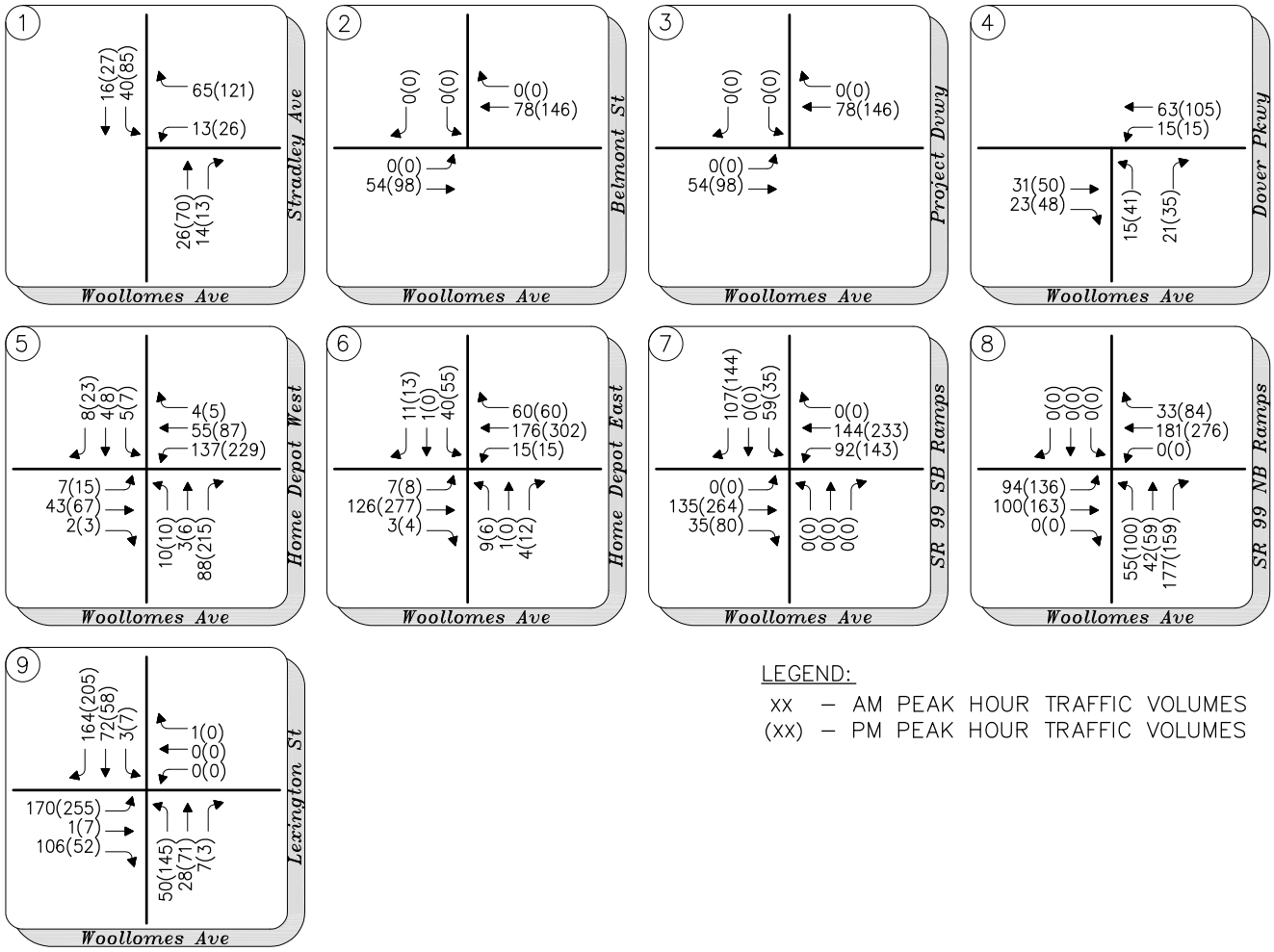
The following critical study intersection were established for this analysis in coordination with the Client and City staff, and are analyzed within this study for weekday AM and PM, and weekend mid-day, peak hour conditions:

1. Woollomes Avenue / Stradley Avenue
2. Woollomes Avenue / Belmont Street
3. Woollomes Avenue / Project Driveway
4. Woollomes Avenue / Dover Parkway
5. Woollomes Avenue / Home Depot West
6. Woollomes Avenue / Home Depot East
7. Woollomes Avenue / SR 99 SB Ramps
8. Woollomes Avenue / SR 99 NB Ramps
9. Woollomes Avenue / S Lexington Street

Figure 3A shows the existing turning movements simulating weekday AM and PM peak hours. Figure 3B presents the existing turning movements simulating Saturday mid-day peak hour conditions. The following roadway segments were analyzed as part of this study:

1. Woollomes Avenue, Stradley Avenue to Belmont Street
2. Woollomes Avenue, Belmont Street to Project Driveway
3. Woollomes Avenue, Project Driveway to Dover Parkway
4. Woollomes Avenue, Dover Parkway to Home Depot East
5. Woollomes Avenue, Home Depot East to SR 99 SB Ramps
6. Woollomes Avenue, SR 99 SB Ramps to SR 99 NB Ramps
7. Woollomes Avenue, SR 99 NB Ramps to S Lexington Street
8. Stradley Avenue, north of Woollomes Avenue
9. Stradley Avenue, south of Woollomes Avenue
10. Lexington Street, north of Woollomes Avenue
11. Lexington Street, south of Woollomes Avenue

Daily volumes on Woollomes Avenue and in the project area were calculated using existing observed peaking characteristics. Existing daily roadway volumes are presented in Figure 4.



LEGEND:

xx – AM PEAK HOUR TRAFFIC VOLUMES
(xx) – PM PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 3A

Existing Peak Hour Volumes

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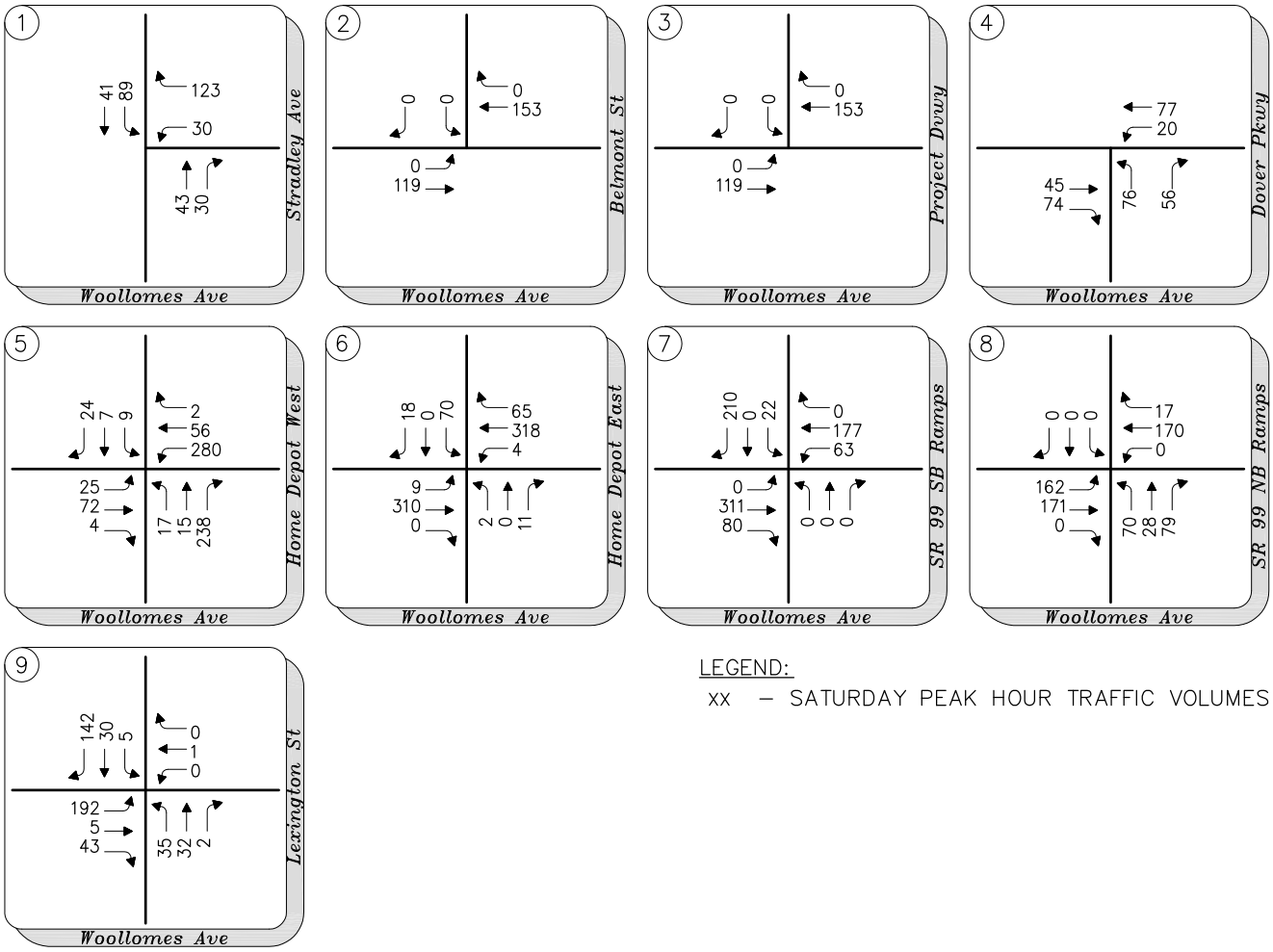

LEGEND:

xx – SATURDAY PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 3B

Existing Saturday Peak Hour Volumes

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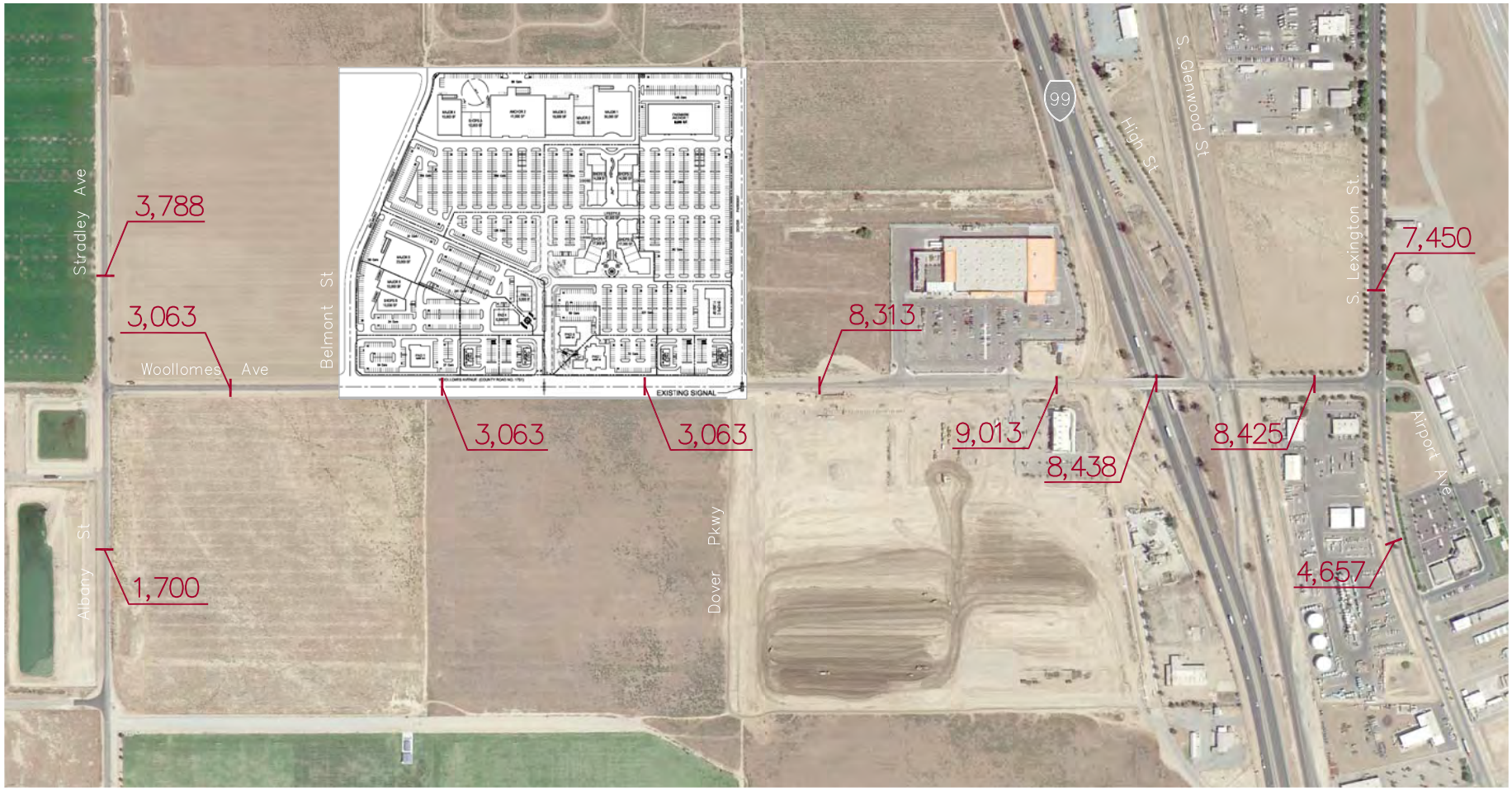

Grapevine Commercial TIAR

Figure 4

Existing Daily Roadway Volumes

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Job No: 25-1691-02

TRAFFIC ANALYSIS PARAMETERS

The following section outlines the methodology and analysis parameters used to quantify existing and projected operations at critical study locations.

GENERAL LOS METHODOLOGIES

Intersection, roadway, ramp, and mainline level-of-service (LOS) has been calculated for all control types using the methods documented in the Transportation Research Board publications *Highway Capacity Manual*. LOS determinations are presented on a letter grade scale from "A" to "F", whereby LOS A represents free-flow operating conditions and LOS "F" represents over-capacity conditions. LOS definitions for different types of intersection controls are presented in Table 1.

TABLE 1
LOS CRITERIA AND DEFINITIONS FOR INTERSECTIONS

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle		
				Signalized	Un signalized	All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	< 10.0	< 10.0	< 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and < 20.0	>10.0 and < 15.0	>10.0 and < 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20.0 and < 35.0	>15.0 and < 25.0	>15.0 and < 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and < 55.0	>25.0 and < 35.0	>25.0 and < 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and < 80.0	>35.0 and < 50.0	>35.0 and < 50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0	> 50.0	> 50.0

References: Highway Capacity Manual

INTERSECTION LOS METHODOLOGIES

Most of the intersection LOS will be calculated for all control types using the *Synchro 8* software by Trafficware, implementing the methods documented in the Transportation Research Board publication *Highway Capacity Manual*.

Typically LOS and delay are sole determinant acceptable for traffic network operations analysis. However, the close proximity of the intersections at Woollomes Avenue interchange and short turn pocket lengths greatly increases the likelihood that a critical movement at an intersection will block adjacent intersections. This behavior is not captured within the isolated intersection analysis in Synchro and needs to be documented using micro-simulation analysis.

Synchro is bundled with micro-simulation software, Sim-Traffic, which uses the Synchro network as the direct input data. As noted previously, micro-simulation allows for more detailed study of the interaction between intersections. Woollomes Avenue from Intersection 4 through intersection 8 will be analyzed using Sim-Traffic software. The analyses will include delay, LOS and 95th percentile queue lengths for those intersections. The remainder intersections will be analyzed using Synchro 8 software.

The micro-simulation model simulates actual field conditions for existing scenarios. Travel time study was performed during PM peak hour to determine the congested travel time from intersection 4 through intersection 8. Ten (10) runs were taken on both directions to determine the average travel time. The travel time was used to validate the existing PM peak hour model.

ROADWAY LOS METHODOLOGIES

Consistent with the City of Delano Circulation Element, the Florida Department of Transportation's *Florida's Level of Service Standards and Guidelines Manual for Planning* will be used to evaluate roadway segments on a volume-to-capacity basis. Table 2 presents the roadway LOS thresholds by facility type in the study area.

TABLE 2
DAILY ROADWAY LOS THRESHOLDS

	LOS "A"	LOS "B"	LOS "C"	LOS "D"	LOS "E"
All Facilities (Volume-to-Capacity Ratio (V/C))	<0.6	0.6-0.7	0.7-0.8	0.8-0.9	0.9-1.0
	Two-way Average Daily Traffic (ADT) Threshold				
Roadway Segment Type	**LOS "A"**	**LOS "B"**	**LOS "C"**	**LOS "D"**	**LOS "E"**
6-Lane Divided (>4.5 signals/mi.)	0	0	17,730	39,330	43,380
4-Lane Divided (>4.5 signals/mi.)	0	0	11,340	25,380	28,710
2-Lane Undivided (>4.5 signals/mi.)	0	0	4,845	11,305	14,155
6-Lane Divided (>4.5 signals/mi.)	0	0	35,100	45,270	47,790
4-Lane Divided (2 to 4.5 signals/mi.)	0	0	22,500	29,880	31,590
2-Lane Undivided (2 to 4.5 signals/mi.)	0	0	9,450	13,680	14,580
4-Lane Undivided (<2 signals/mi.)	0	19,045	23,075	23,855	-
2-Lane Undivided (<2 signals/mi.)	0	8,640	13,860	14,850	-

Note: 1. Based on "2009 FDOT Quality/Level of Service Handbook", Florida Department of Transportation. Adjustments made according to appropriate area conditions, following FDOT guidelines.

2. All volumes are approximate and assume typical roadway characteristics. Actual threshold volumes for each Level of Service listed above may vary depending on a variety of factors including (but not limited to) roadway curvature and grade, intersection or interchange spacing, driveway spacing, percentage of trucks and other heavy vehicles, travel lane widths, signal timing characteristics, on-street parking, volume of cross traffic and pedestrians, etc.

RAMP & MAINLINE LOS METHODOLOGIES

Ramp & mainline LOS will be calculated using *HCS 2010* software by McTrans. LOS will be calculated on a density basis in passenger cars per mile per lane (pc/mi/ln).

APPLICABLE LOS POLICIES

The *City of Delano 2030 General Plan* establishes LOS "C" or "D" as the threshold for acceptable operations on roadway segments and intersections in the City on page 3-35 of the *Circulation Element*. LOS "D" is acceptable, per the policy, on freeway interchanges and high volume intersections.

A. Achieve and maintain Level of Service "C" all intersection throughout the City, with the exception of freeway interchanges and high volume intersections where the City's objective is to achieve and maintain Level of Service "D".

The Caltrans published *Guide for the Preparation of Traffic Impact Studies* (dated June 2001) states the following:

> *"Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities ..."*

For purposes of this traffic study, and consistent with City policies stated above, LOS "D" has been taken as the minimum acceptable LOS standard for all study intersection locations, since it is being developed as a high-volume commercial corridor or/and on freeway interchange. This includes the SR 99 interchange ramp terminal intersections on Woollomes Avenue. As required by the Caltrans District 06, for SR 99 mainline segments and ramps, LOS "C" has been taken as the minimum acceptable LOS standard at study locations. For the roadway segments on Woollomes Avenue, LOS "D" will be minimum acceptable LOS standard and for other roadway segment it will be LOS "C".

Appropriate circulation, capacity and/or control improvements will be identified for instances when study area facilities are projected to operate below acceptable standards.

TRAFFIC SIGNAL WARRANTS

A supplemental traffic signal warrant analysis will be completed to determine whether unsignalized study intersections may require or benefit from the installation of a traffic signal if an unsignalized intersection is determined to operate at unacceptable service levels. The term "signal warrant" refers to any of the eight established methods used by Caltrans to quantify the need for a traffic signal at an unsignalized intersection. The eight signal warrant methods are described in the latest edition of the California Manual on Uniform Traffic Control Devises (MUTCD).

The California MUTCD indicates that the installation of a traffic signal should be considered only if one or more of the eight signal warrants are met. The TIAR for the Proposed Project will perform the peak hour volume-based Warrant 3 on study intersections projected to operate below acceptable service levels. The results of the included signal warrant analyses may indicate that a traffic signal could be beneficial to the operations of an intersection.

EXISTING TRAFFIC OPERATIONS

Existing AM and PM, and Saturday peak hour intersection traffic operations were quantified utilizing the existing intersection lane geometrics and control (Figure 2) and the existing traffic volumes (Figures 3A and 3B). Table 3 contains a summary of the existing intersection LOS conditions.

TABLE 3
EXISTING CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	Woollomes Ave / Stradley Ave	TWSC	D	9.0	A	9.9	A	9.9	A
2	Woollomes Ave / Belmont St	PLUS-PROJECT CONDITIONS ONLY							
3	Woollomes Ave / Project Driveway								
4	Woollomes Ave / Dover Pkwy[4]	Signal	D	3.8	A	4.2	A	4.1	A
5	Woollomes Ave / Home Depot West[4]	Signal	D	9.1	A	9.2	A	10.9	B
6	Woollomes Ave / Home Depot East	TWSC	D	11.3	B	14.6	B	15.1	C
7	Woollomes Ave / SR 99 SB Ramps[4]	Signal	D	10.7	B	11.5	B	10.3	B
8	Woollomes Ave / SR 99 NB Ramps[4]	Signal	D	10.9	B	13.6	B	14.0	B
9	Woollomes Ave / Lexington St	AWSC	D	10.2	B	13.8	B	9.9	A

Notes:
1. TWSC = Two Way Stop Control AWSC = All-way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections
3. Warrant = Based on California MUTCD Warrant 3
4. The intersection's delay is reported using Sim-Traffic due to its close proximately. The average delay is obtain by perfoming 5 simulation runs.

As presented in Table 3, there are no LOS-based intersection deficiencies observed during existing conditions analysis. Table 4 shows the existing daily roadway segment LOS analysis results.

TABLE 4
EXISTING CONDITIONS: DAILY ROADWAY LOS

#	Roadway Segment	Capacity Configuration	Target LOS	Existing	
				ADT	LOS
1	Woollomes Avenue (Stradley Avenue to Belmont Street)	2-Lane Undivided (<2 signals/mi.)	D	3,063	≤ B
2	Woollomes Avenue (Belmont Street to Project Driveway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	3,063	≤C
3	Woollomes Avenue (Project Driveway to Dover Parkway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	3,063	≤C
4	Woollomes Avenue (Dover Parkway to Home Depot East)	6-Lane Divided (>4.5 signals/mi.)	D	8,313	≤C
5	Woollomes Avenue (Home Depot East to SR 99 SB Ramps)	4-Lane Divided (>4.5 signals/mi.)	D	9,013	≤C
6	Woollomes Avenue (SR 99 SB Ramps to SR 99 NB Ramps)	2-Lane Undivided (>4.5 signals/mi.)	D	8,438	D
7	Woollomes Avenue (SR 99 NB Ramps to Lexington Street)	2-Lane Undivided (>4.5 signals/mi.)	D	8,425	D
8	Stradley Avenue (north of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	3,788	≤ B
9	Stradley Avenue (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	1,700	≤ B
10	Lexington Street (north of Woollomes Avenue)	4-Lane Undivided (<2 signals/mi.)	C	7,450	≤ B
11	Lexington Street (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	4,657	≤ B

Note: Daily Volume estimates based on a 0.08 to 1 peak hour to daily volume ratio, as observed at east and west of SR 99 on Woollomes Avenue.

As presented in Table 4, under existing conditions daily volumes are not expected to exceed acceptable roadway LOS capacity in the project study area.

SR 99 mainline and ramp merge/diverge operations are presented in Table 5 and 6 respectively.

TABLE 5
EXISTING CONDITIONS: MAINLINE LOS

			AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak		
Freeway Mainline Segment	No. Lanes	Target LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln	LOS
SR 99 NB north of Woollomes Ave	2	C	1,555	13.3	B	2,120	18.2	B	1,580	13.5	B
SR 99 NB south of Woollomes Ave	2	C	1,702	14.6	B	1,236	19.0	C	1,578	13.5	B
SR 99 SB north of Woollomes Ave	2	C	1,583	13.6	B	1,893	16.2	B	1,621	13.9	B
SR 99 SB south of Woollomes Ave	2	C	1,544	13.2	B	1,937	16.6	B	1,532	13.1	B

TABLE 6
EXISTING CONDITIONS: RAMPS LOS

			AM Peak Hour		PM Peak Hour		SAT MID-DAY Peak Hour	
Interchange Location	Target LOS	Junction Type	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
SR 99 Ramps at Woollomes Ave								
SR 99 Northbound On-Ramp	C	Merge	18.1	B	22.0	C	17.7	B
SR 99 Northbound Off-Ramp	C	Diverge	18.9	B	23.5	C	17.3	B
SR 99 Southbound On-Ramp	C	Merge	17.8	B	23.0	C	17.7	B
SR 99 Southbound Off-Ramp	C	Diverge	18.6	B	20.7	C	18.0	B

As presented in Table 5 & Table 6, there are no LOS-based mainline segment and ramp deficiencies observed during existing conditions analysis.

Table 7 presents the 95th percentile queues for intersection 4 through intersection 8.

TABLE 7
EXISTING CONDITIONS: 95TH PERCENTILE QUEUES

Critical Movement on Woollomes[a]	Storage Length (ft)	95th Percentile Queue (ft)[b]		
		AM	PM	Mid-day Sat
Woollomes Ave / Dover Pkwy				
Eastbound Right	*150*	36	41	42
Westbound Left	*250*	26	26	32
Northbound Left	*200*	19	34	45
Woollomes Ave / Home Depot West				
Eastbound Left	*250*	26	34	45
Eastbound Right	*250*	13	15	20
Westbound Left	*300*	100	131	141
Westbound Right	*300*	4	5	6
Southbound Left/Through/Right	*250 (approx.)*	25	36	38
Woollomes Ave / SR 99 SB Ramps				
Eastbound Through[1]	*>600*	85	127	132
Eastbound Right	*>250*	32	26	30
Westbound Left	***100***	94	**114**	72
Westbound Through	*>450*	95	102	97
Southbound Left/Through	*>350*	51	38	23
Southbound Right	*300*	58	56	56
Woollomes Ave / SR 99 NB Ramps				
Eastbound Left	*275*	93	120	129
Eastbound Through	*>450*	80	101	99
Westbound Through/Right	*>500*	114	162	95
Northbound Left	*300*	45	82	61
Northbound Through	*>500*	32	51	28
Northbound Right	*550*	71	57	43

Notes:

A. Queuing of only critical movement shown in the Table. Other movement's 95th Percentile queue can be found in the Sim-Traffic Report.

B. 95th Pecentile Queue Length are determined from five (5) Sim-Traffic Run for each conditions.

1. The storage shown for eastbound through movement is from the SR 99 Ramps to the Home Depot West (Signalized) intersection.

As shown in Table 7, the 95th percentile queue for the westbound left movement at Woollomes Avenue and SR 99 southbound ramps intersection will experience queuing higher than the storage length. To accommodate 95th percentile queue, the storage pocket needs to be extended from 100 feet to 150 feet. Since the westbound left turn pocket (at the intersection of Woollomes Avenue & SR 99 SB ramps) and eastbound left turn pocket (at the intersection of Woollomes Avenue & SR 99 NB ramps) are back-to-back, 50 feet of storage from the eastbound left turn pocket needs to be reduced.

EXISTING CONDITIONS IMPROVEMENT RECOMMENDATION

To accommodate 95th percentile queues following improvement needs to be constructed:

- Add 50 feet of storage for westbound left turn pocket (at Woollomes Ave & SR 99 SB ramps)
- Reduce 50 feet of storage for eastbound left turn pocket (at Woollomes Ave & SR 99 NB ramps)

PROPOSED PROJECT DESCRIPTION

The proposed retail and restaurant use project is on an approximately 44.64 acre site on the southern edge of the City on the north side of Woollomes Avenue, about ½ mile west of the Woollomes Avenue/State Route 99 (SR 99) interchange. Figure 5 shows the proposed project site plan.

PROJECT TRIP GENERATION

Project trip generation has been estimated using the *ITE Trip Generation Manual (9th Edition)*. A Shopping Center trip generation rate was applied to the site, to include all proposed uses. This methodology was selected over generating trip estimates for individual project components, as it accounts for the internal trip capture dynamics between complimentary land uses observed in similar centers. Table 8 presents the trip generation estimates for the Proposed Project.

TABLE 8
PROPOSED PROJECT TRIP GENERATION ESTIMATE

Land Use Category (ITE Code)	Unit[1]	Daily Trip Rate/Unit[2]	AM Peak Hour Trip Rate/Unit			PM Peak Hour Trip Rate/Unit			SAT Peak Hour Trip Rate/Unit		
			Total	In %	Out	Total	In %	Out	Total	In %	Out
Shopping Center (ITE 820)	KSF	44.79	0.98	62%	38%	4.05	48%	52%	5.77	52%	48%
Project Name	**Quantity (Units)**	**Daily Trips**	**AM Peak Hour Trips**			**PM Peak Hour Trips**			**PM Peak Hour Trips**		
			Total	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**
Grapevine Center	**329**	**14,712**	**322**	**200**	**122**	**1,329**	**638**	**691**	**1,894**	**985**	**909**

Notes:
1. 1 ksf = 1,000 square feet
2. Trip rates based on ITE Trip Generation Manual 9th Edition Fitted Curve Equations

As presented in Table 8, a total of 14,712 daily trips are projected to be generated by the proposed project. The proposed project is expected to generate 322 AM peak hour trips, 1,329 PM peak hour trips, and 1,894 Saturday mid-day peak hour trips.

PASS-BY TRIPS, TRIP CHAINING, AND INTERNAL TRIP CAPTURE

Pass-by trips are defined as trips already on a roadway that divert into the project driveway between their original origin and destination. These are common, for example, with fast food restaurants on a heavily used commuter arterial. No pass-by trips are assumed for this project, as it is assumed to be a "destination" commercial center rather than a "pass by" retail or dining project. However, trips from adjacent commercial uses are accounted for in the study's trip distribution pattern. This accounts for "trip chaining" where multiple locations in close proximity are visited by patrons. An example of this, in the case of the proposed project, would be a trip to the proposed project from the adjacent Walmart store in the Delano Marketplace development.

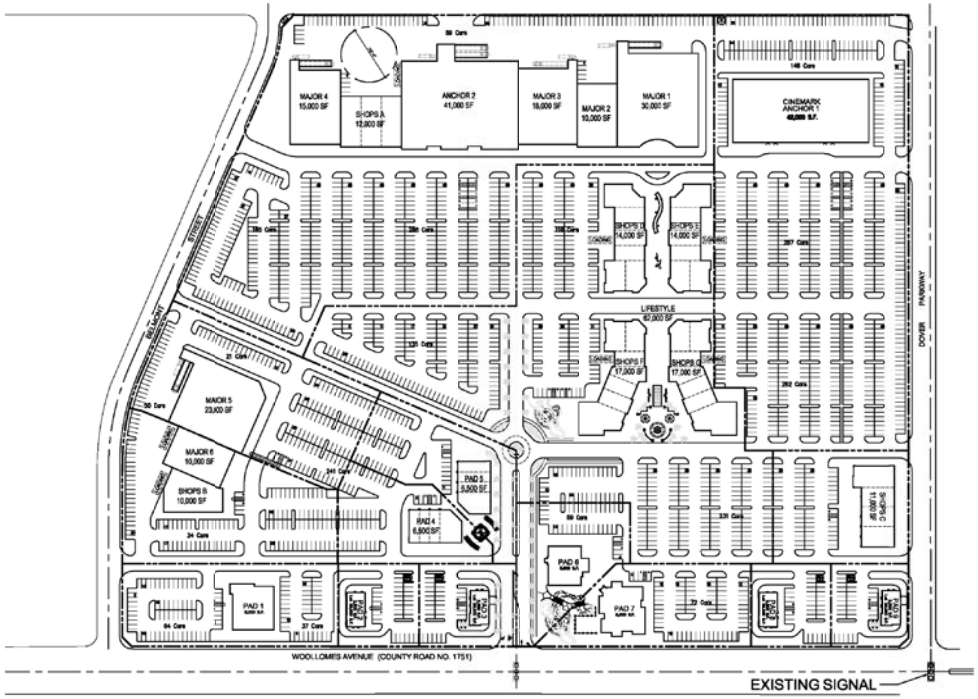
Internal trip capture rates refer to the expected number of on-site trips between distinct uses within a proposed project. An internal trip capture rate may be applied to a large commercial development, such as the proposed project, if the trip generation is based on individual land uses within the project (Fast food, specialty retail, sit-down restaurant, discount store, etc.) However, by using the *ITE 820 Shopping Center* land use category to generate trips, an internal trip capture is already "built in" to the trip rate as it accounts for the variety of mixed uses on site and only counts trips in and out of the project driveway.

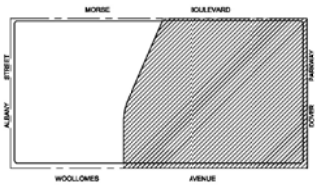
TRIP DISTRIBUTION

Directional project trip distribution was developed based on an understanding of existing and projected future land uses and circulation patterns within the project vicinity. Figure 6 presents the Proposed Project directional trip distribution estimate.

As presented in Figure 6, the majority of project trips are expected to be to and from SR 99 rather than local surface streets. Only a small component of project traffic is expected to come from local surface streets via South Albany Street/Stradley Avenue, High Street, and Lexington Street. The currently underway Woollomes Avenue/SR 99 interchange improvement project will preclude southbound traffic from High Street from accessing Woollomes Avenue, and therefore will preclude inbound project traffic from that direction. Similarly, the currently underway interchange project will also result in reconfiguration of Garzoli Avenue to end in a cul-de-sac just south of Woollomes Avenue and will preclude direct access to/from Woollomes Avenue. The proposed Belmont Street and Dover Parkway extensions will provide ancillary local access to residential areas west of SR 99 and north of the project.

Figures 8A and 8B present the "Project Only" traffic volumes for AM and PM weekday peak hour conditions and Saturday mid-day peak hour conditions respectively. Figure 7 presents the "Plus Project" intersection lane geometrics.





KEY PLAN

SITE PLAN

NORTH

PROJECT DATA

The Grapevine Project Data
3/11/2013

	Pad	Lot (SF)	Building (SF)	Retail (SF)	Food (SF)	Parking (Stalls) Provided	Parking (Stalls) Required
Outparcel	1	70,304	8,000	0	8,000	101	96
	2	26,270	2,500	0	2,500	31	25
	3	31,360	2,500	0	2,500	30	25
	4	43,773	6,500	3,950	2,550	45	45
	5	52,340	6,500	3,950	2,550	47	45
	6	46,785	5,500	5,500	0	36	28
	7	57,153	8,000	0	8,000	76	96
	8	26,306	2,500	0	2,500	31	25
	9	25,048	2,500	0	2,500	30	25
	Shops C	60,338	11,000	7,563	3,437	70	72
	Subtotal	**439,677**	**55,500**	**20,963**	**34,537**	**497**	**482**
Lifestyle	Shops D	396,564	14,000	10,760	3,240	502	86
	Shops E		14,000	10,760	3,240		86
	Shops F		17,000	10,160	6,840		133
	Shops G		17,000	10,160	6,840		133
	Subtotal	**396,564**	**62,000**	**41,840**	**20,160**	**502**	**438**
Anchor 1		324,673	42,000	42,000	0	695	735
	Subtotal	**324,673**	**42,000**	**42,000**	**0**	**695**	**735**
Anchor 2		453,715	41,000	41,000	0	561	205
Major	1		30,000	30,000	0		150
	2		10,000	10,000	0		50
	3		18,000	18,000	0		90
	4		15,000	15,000	0		75
	Shops A		12,000	12,000	0		60
	5	100,074	23,000	23,000	0	132	115
	6	97,192	10,000	10,000	0	125	50
	Shops B		10,000	10,000	0		50
	Subtotal	**650,981**	**169,000**	**169,000**	**0**	**818**	**845**
Total		**1,811,895** (41.6 AC)	**328,500**	**273,803**	**54,697**	**2,512**	**2,500**

YK America

PROJECT
THE GRAPEVINE
DELANO, CA

CONTRACTOR

ISSUES AND REVISIONS

NO.	DESCRIPTION	DATE
1	MS S.F. UPDATED	12.17.2012
2	Anchor 1 Lease Req. -Parking Update	01.22.2013
3	Justin Comment	02.07.2013
4	Architect Prelim Update	03.07.2013

JOB NUMBER
DATE 03.11.2013
SCALE 1/ 64" = 1' - 0"
FILE NAME SP
DRAWN BY KP
APPROVED BY JH

PROJECT
THE GRAPEVINE

SOUTHWEST CORNER OF WOOLLOMES AVE. & BELMONT ST.

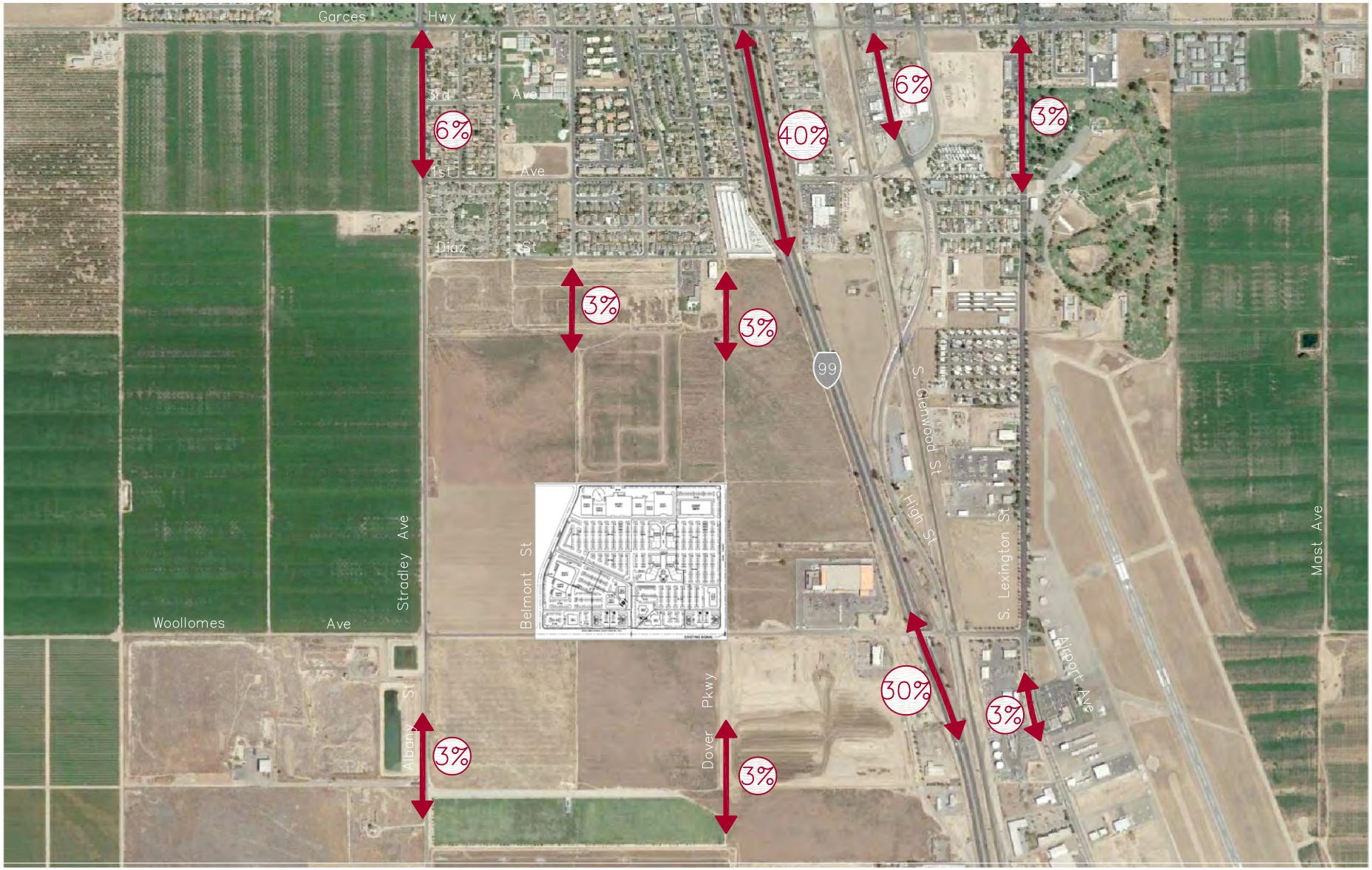
DELANO, CA

A 1.0

Grapevine Commercial TIAR

Figure 5

Proposed Project Site Plan



Grapevine Commercial TIAR

Figure 6

Proposed Project Trip Distribution

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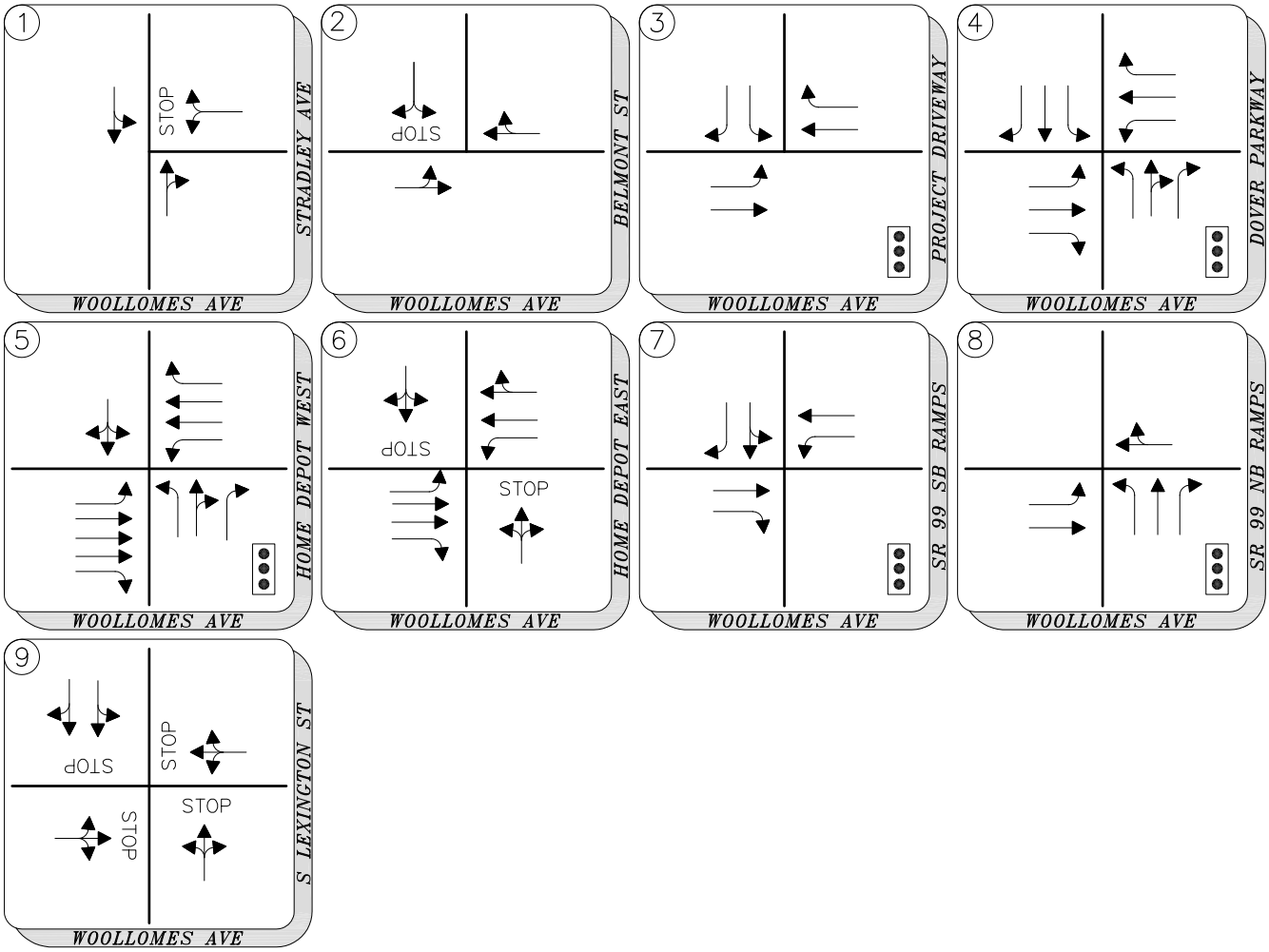

Grapevine Commercial TIAR

Figure 7

"Plus Project" Intersection Lane Geometrics and Control Types

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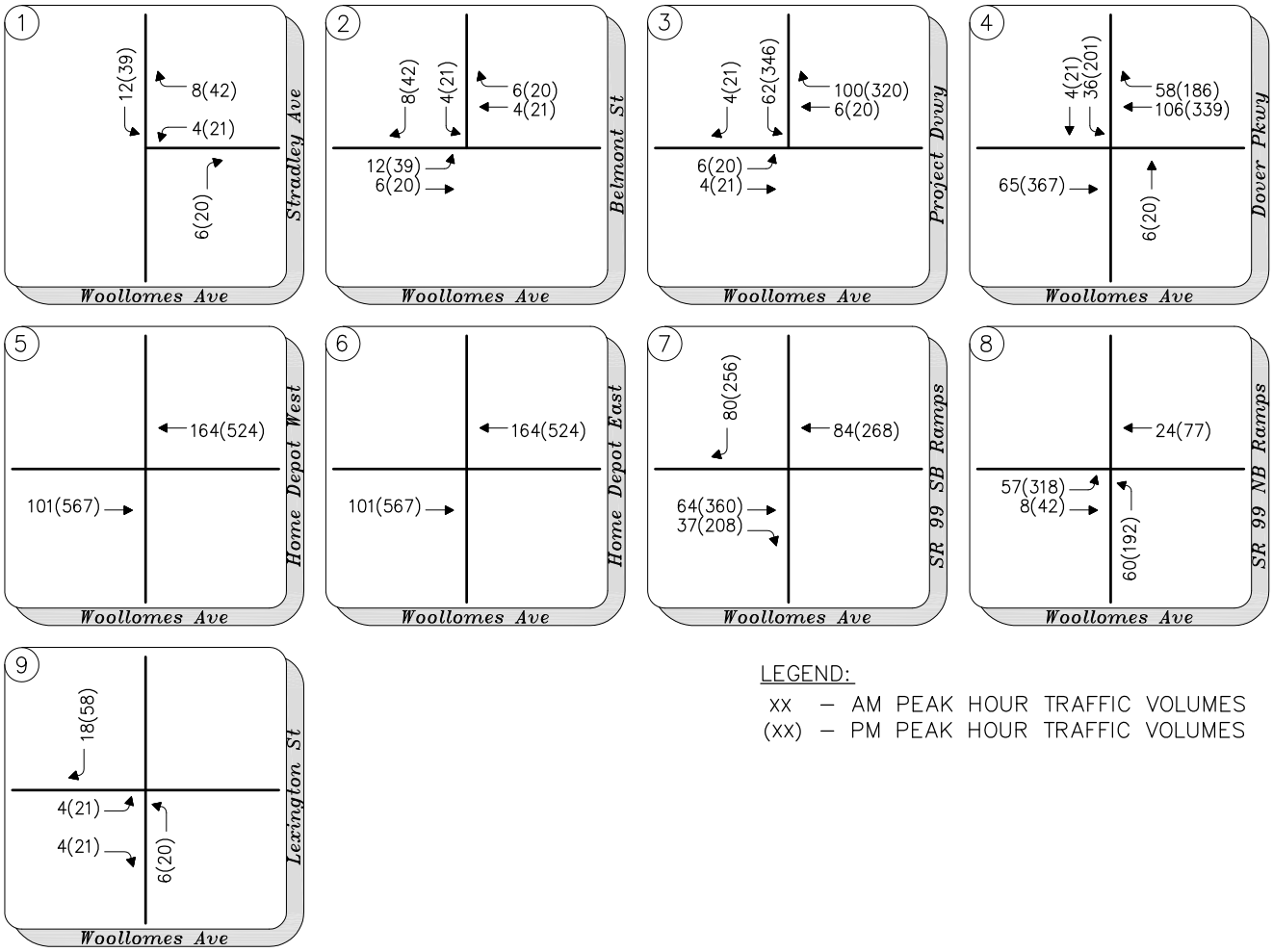

LEGEND:

xx – AM PEAK HOUR TRAFFIC VOLUMES
(xx) – PM PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 8A

"Project Only" AM & PM Peak Hour Volumes

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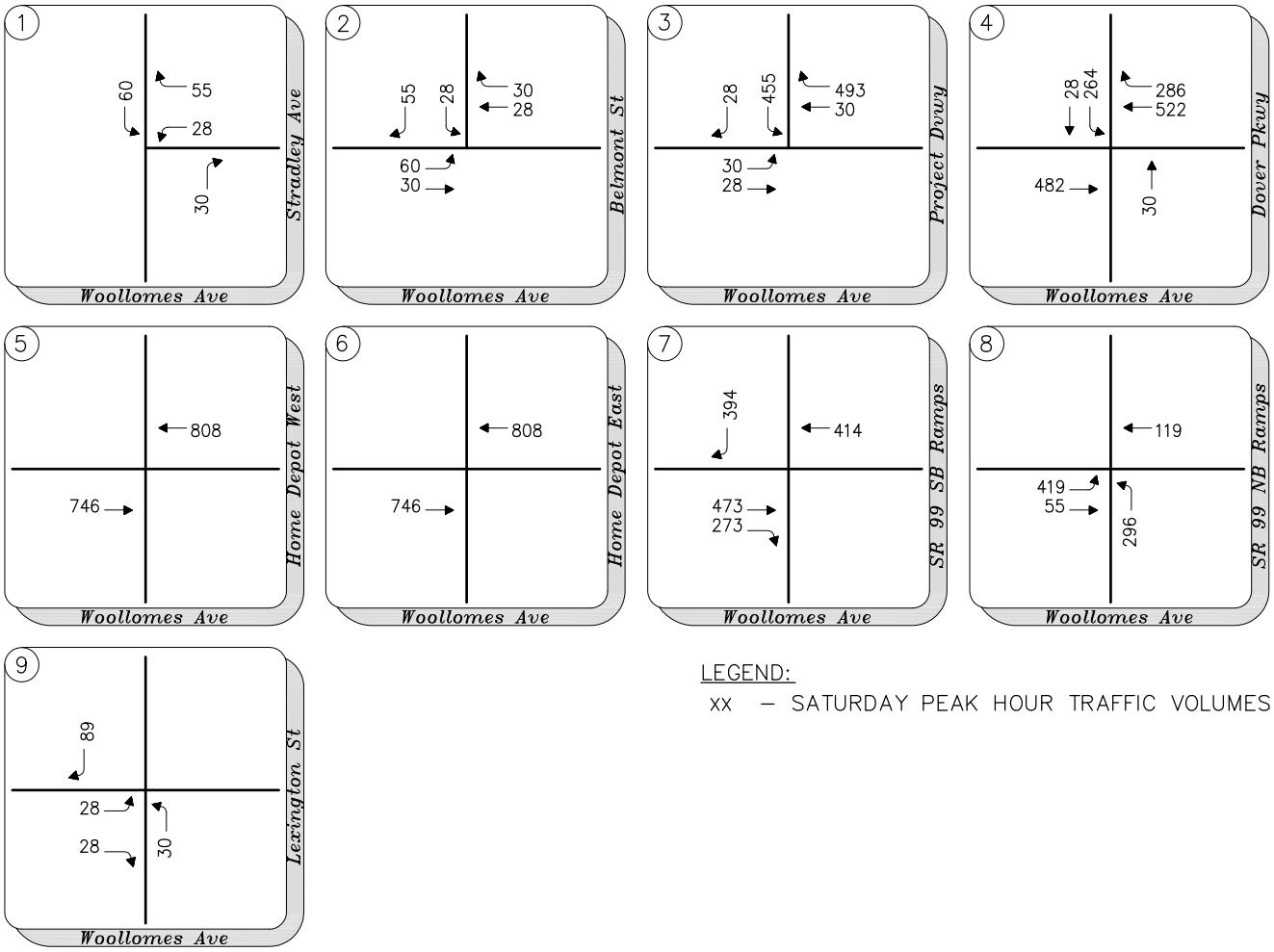

LEGEND:

xx – SATURDAY PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 8B

"Project Only" Saturday Peak Hour Volumes

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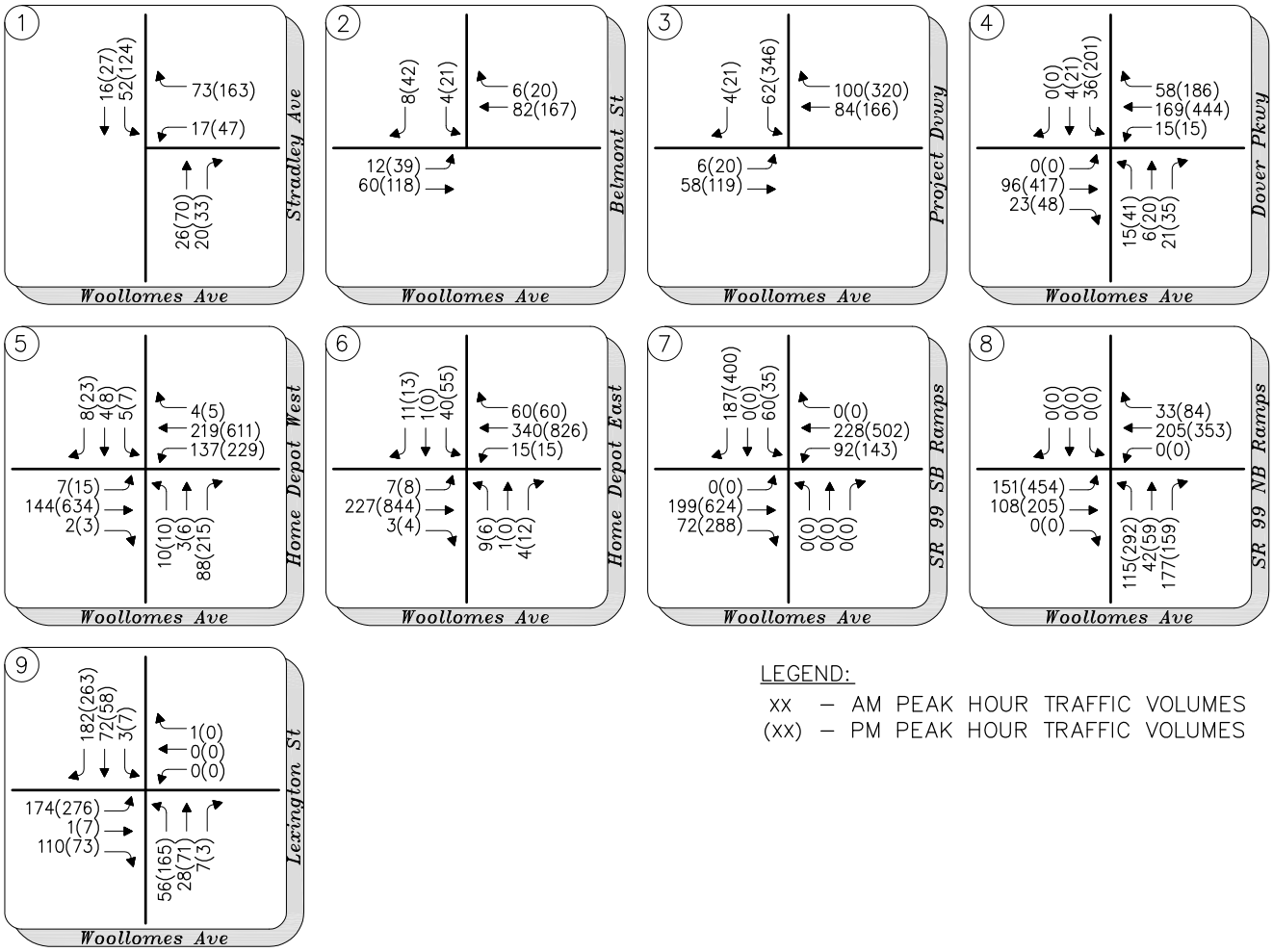

LEGEND:

xx – AM PEAK HOUR TRAFFIC VOLUMES
(xx) – PM PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 9A

Existing Plus Project AM & PM Peak Hour Volumes

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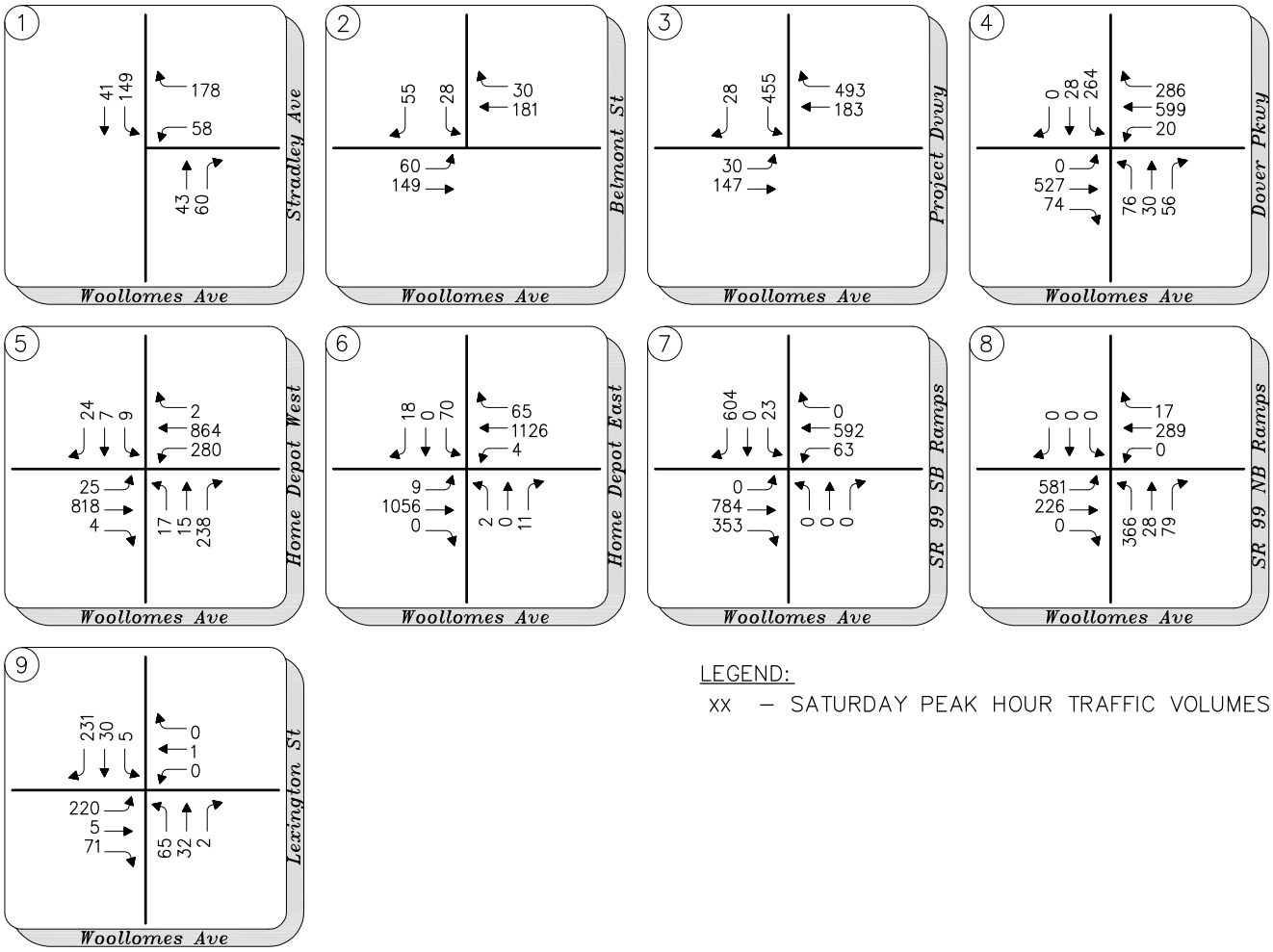

LEGEND:

xx – SATURDAY PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 9B

Existing Plus Project Saturday Peak Hour Volumes

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EXISTING PLUS PROJECT TRAFFIC OPERATIONS

Existing Plus Project conditions were developed by superimposing proposed AM, PM, and Saturday peak hour project-generated trips (Figures 8A & 8B) using the proposed project trip distribution (Figure 6) onto *Existing* conditions traffic volumes (Figures 3A & 3B).

The resulting *Existing Plus Project* traffic volumes are presented in Figures 9A and 9B. Intersection analysis was performed assuming the "Plus Project" intersection lane geometrics and control types (Figure 7). Table 9 presents the results of the *Existing Plus Project* intersection conditions analysis.

TABLE 9
EXISTING PLUS PROJECT CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	Woollomes Ave / Stradley Ave	TWSC	D	9.2	A	11.0	B	11.7	B
2	Woollomes Ave / Belmont St	TWSC	D	9.1	A	10.4	B	11.1	B
3	Woollomes Ave / Project Driveway	Signal	D	7.7	A	11.1	B	20.7	C
4	Woollomes Ave / Dover Pkwy[4]	Signal	D	5.5	A	10.9	B	14.9	B
5	Woollomes Ave / Home Depot West[4]	Signal	D	8.8	A	13.3	B	27.9	C
6	**Woollomes Ave / Home Depot East**	**TWSC**	**D**	14.3	B	**82.5**	**F**	**OVR**	**F**
7	Woollomes Ave / SR 99 SB Ramps[4]	Signal	D	10.7	B	15.0	B	20.7	C
8	Woollomes Ave / SR 99 NB Ramps[4]	Signal	D	12.8	B	19.5	B	28.6	C
9	Woollomes Ave / Lexington St	AWSC	D	10.5	B	17.2	C	11.9	B

Notes:
1. TWSC = Two Way Stop Control AWSC = All-way Stop Control OVR = Delay exceeds 300 seconds
2. LOS = Delay based on worst minor street approach for TWSC intersections
3. Warrant = Based on California MUTCD Warrant 3
4. The intersection's delay is reported using Sim-Traffic due to its close proximately. The average delay is obtain by perfoming 5 simulation runs.

As presented in Table 9, there is only one (1) intersection LOS deficiencies identified in the *Existing Plus Project* conditions analysis. The intersection of Wollomes Avenue & Home Depot East is projected to operate at unacceptable LOS F during the PM peak hour and Saturday mid-day peak hour conditions.

Table 10 presents the 95th percentile queues for intersection 4 through intersection 8.

TABLE 10
EXISTING PLUS PROJECT CONDITIONS: 95TH PERCENTILE QUEUES

Critical Movement on Woollomes[a]	Storage Length (ft)	95th Percentile Queue (ft)[b]		
		AM	PM	Mid-day Sat
Woollomes Ave / Dover Pkwy				
Eastbound Left	*150*	0	0	0
Eastbound Right	*150*	30	28	91
Westbound Right	*250*	23	53	85
Northbound Left	*200*	29	45	73
Southbound Left	*200*	43	129	170
Southbound Right	*200*	0	0	0
Woollomes Ave / Home Depot West				
Eastbound Left	*250*	31	38	200
Eastbound Right	*250*	11	14	19
Westbound Left	*300*	99	163	184
Westbound Right	*300*	6	9	3
Southbound Left/Through/Right	*250 (approx.)*	26	42	38
Woollomes Ave / SR 99 SB Ramps				
Eastbound Through	*>600*	104	349	453
Eastbound Right	*>250*	38	91	94
Westbound Left[2]	*150*	103	141	99
Westbound Through	*>450*	125	208	294
Southbound Left/Through	*>350*	52	42	395
Southbound Right	***300***	70	156	**421**
Woollomes Ave / SR 99 NB Ramps				
Eastbound Left[2]	***225***	130	**306**	**387**
Eastbound Through	*>450*	77	152	331
Westbound Through/Right	*>500*	131	299	281
Northbound Left	*300*	89	229	271
Northbound Through	*>500*	32	74	45
Northbound Right	*550*	61	64	52

Notes:

A. Queuing of only critical movement shown in the Table. Other movement's 95th Percentile queue can be found in the Sim-Traffic Report.

B. 95th Pecentile Queue Length are determined from five (5) Sim-Traffic Run for each conditions.

1. The storage shown for eastbound through movement is from the SR 99 Ramps to the Home Depot West (Signalized) intersection.

2. The 50 feet reduction from eastbound left turn lane (at SR 99 NB ramps) and addition to the westbound right turn lane (at SR 99 SB ramps) implemented as per the existing conditions recommended improvement.

As shown in Table 10, southbound right turn movement at intersection of Woollomes Avenue & SR 99 SB ramps and eastbound left turn movement at intersection of Woollomes Avenue & SR 99 NB ramps are projected to experience 95th percentile queue that will exceed the storage length. The mitigation is provided in the Mitigation section.

Table 11 presents the *Existing Plus Project* daily roadway segment LOS analysis results, which were generated by adding the project's daily traffic generation to roadway segments following the proposed distribution patterns in Figure 6.

TABLE 11
EXISTING PLUS PROJECT CONDITIONS: DAILY ROADWAY LOS

#	Roadway Segment	Capacity Configuration	Target LOS	Existing Plus Project	
				ADT	LOS
1	Woollomes Avenue (Stradley Avenue to Belmont Street)	2-Lane Undivided (<2 signals/mi.)	D	4,389	B
2	Woollomes Avenue (Belmont Street to Project Driveway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	4,831	C
3	Woollomes Avenue (Project Driveway to Dover Parkway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	14,247	**E**
4	Woollomes Avenue (Dover Parkway to Home Depot East)	6-Lane Divided (>4.5 signals/mi.)	D	20,377	D
5	Woollomes Avenue (Home Depot East to SR 99 SB Ramps)	4-Lane Divided (>4.5 signals/mi.)	D	21,077	D
6	Woollomes Avenue (SR 99 SB Ramps to SR 99 NB Ramps)	2-Lane Undivided (>4.5 signals/mi.)	D	15,354	**F**
7	Woollomes Avenue (SR 99 NB Ramps to Lexington Street)	2-Lane Undivided (>4.5 signals/mi.)	D	10,191	D
8	Stradley Avenue (north of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	4,672	B
9	Stradley Avenue (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	2,142	B
10	Lexington Street (north of Woollomes Avenue)	4-Lane Undivided (<2 signals/mi.)	C	8,776	B
11	Lexington Street (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	5,099	B

Note: Daily Volume estimates based on a .08 to 1 peak hour to daily volume ratio, based on expected changes in new generated traffic in the area.

As presented in Table 11, two (2) roadway segments are projected to be over capacity in the *Existing Plus Project* conditions. Specifically, Woollomes Avenue between the Project Driveway and Dover Parkway and Woollomes Avenue between ramps are anticipated to exceed daily capacity thresholds. While daily roadway LOS analysis is helpful in identifying possible capacity issues on a corridor, the intersection operations analysis supersede segment-level analysis. For this reason, this study will utilize the intersection operations analysis to identify improvements and mitigations. The mitigation of adjacent intersections operating at unacceptable LOS, delay and queuing in Table 9 and Table 10 will mitigate the LOS deficiencies for this roadway.

SR 99 mainline and ramp merge/diverge operations are presented in Tables 15 and 16 respectively. As presented in Tables 12 and 13, no deficiencies are projected during *Existing Plus Project* on the ramps or mainline segments.

TABLE 12
EXISTING PLUS PROJECT CONDITIONS: MAINLINE LOS

			AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak		
Freeway Mainline Segment	No. Lanes	Target LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln	LOS
SR 99 NB north of Woollomes Ave	2	C	1,552	13.3	B	2,246	19.2	C	1,348	11.6	B
SR 99 NB south of Woollomes Ave	2	C	1,702	14.6	B	2,218	19.0	C	1,578	13.5	B
SR 99 SB north of Woollomes Ave	2	C	1,626	13.9	B	1,941	16.6	B	1,742	14.9	B
SR 99 SB south of Woollomes Ave	2	C	1,544	13.2	B	1,937	16.6	B	1,532	13.1	B

TABLE 13
EXISTING PLUS PROJECT CONDITIONS: RAMPS LOS

			AM Peak Hour		PM Peak Hour		SAT MID-DAY	
Interchange Location	Target LOS	Junction Type	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
SR 99 Ramps at Woollomes Ave								
SR 99 Northbound On-Ramp	C	Merge	18.0	B	23.5	C	15.7	B
SR 99 Northbound Off-Ramp	C	Diverge	18.9	B	23.5	C	17.3	B
SR 99 Southbound On-Ramp	C	Merge	17.8	B	21.1	C	17.5	B
SR 99 Southbound Off-Ramp	C	Diverge	18.6	B	21.2	C	19.1	B

CUMULATIVE CONDITIONS

For the purposes of this study, *Cumulative* conditions refer to analysis scenarios in which build out of the adopted City of Delano General Plan, along with traffic increases due to regional growth, is accounted for in level-of-service quantifications. The buildout model outputs from the KernCOG travel demand model were obtained and compared to historical Caltrans growth rates, expected growth due to approved/pending and future City projects, and forecasts in the recently approved Delano Market Place I development traffic study.

The KernCOG travel demand model outputs were found to be significantly lower than expected on both the SR 99 mainline and Woollomes Avenue, and inconsistent with the recently approved Delano Market Place I study, observed current traffic patterns, and historical Caltrans growth rates. For the purposes of this study, the KernCOG model projections were increased significantly to reflect historical Caltrans growth rates on the SR 99 mainline, and to reflect anticipated local growth from approved/pending and future City projects in the project vicinity, consistent with the methodologies used in the previously approved Delano Market Place I traffic study.

Two scenarios will be analyzed under these conditions. The *Cumulative No Project* scenario includes the increased traffic projected by the Kern County Travel Demand Model. The *Cumulative Plus Project* scenario subsequently includes trips generated by the proposed *Grapevine Commercial* in addition to General Plan build out traffic.

The following roadway network improvements that are included in the City's Traffic Impact Fee Program (TIF) were assumed in place during *Cumulative* conditions.

1. Woollomes Avenue & SR 99 SB Off Ramps
   (Signalize, 3EBT, 1EBRT, 2WBLT, 2WBT, 2SBLT, 1SBT, 2SBRT)

2. Woollomes Avenue & SR99 NB Ramps
   (Signalize, 2EBLT, 3EBT, 1NBRT, 3WBT, 1WBRT, 1SBRT)

3. Wollomes Avenue & Stradley Street
   (Signalize, 2SBLT, 2NBT, 1NBRT, 1WBRT)

Intersection operations analysis found that the interchange ramp terminal intersection lane geometrics described in the City's TIF were not sufficient to provide acceptable LOS “C” or better operations during cumulative conditions. Assuming the interchange would be designed to support cumulative volumes at the time a PSR is prepared, the following intersection lane geometrics are proposed at the ramp terminals to support cumulative conditions traffic forecasts:

1. Woollomes Avenue & SR 99 SB Off Ramps
   (Signalize, 3EBT, 2EBRT, 1WBLT, 2WBT, 2SBLT, 1SBT, 2SBRT)

2. Woollomes Avenue & SR99 NB Ramps
   (Signalize, 3EBLT, 3EBT, 2NBLT, 1NBT, 1NBRT, 3WBT, 1WBRT)

Figure 10 shows the intersection lane geometrics and control types for cumulative analysis.

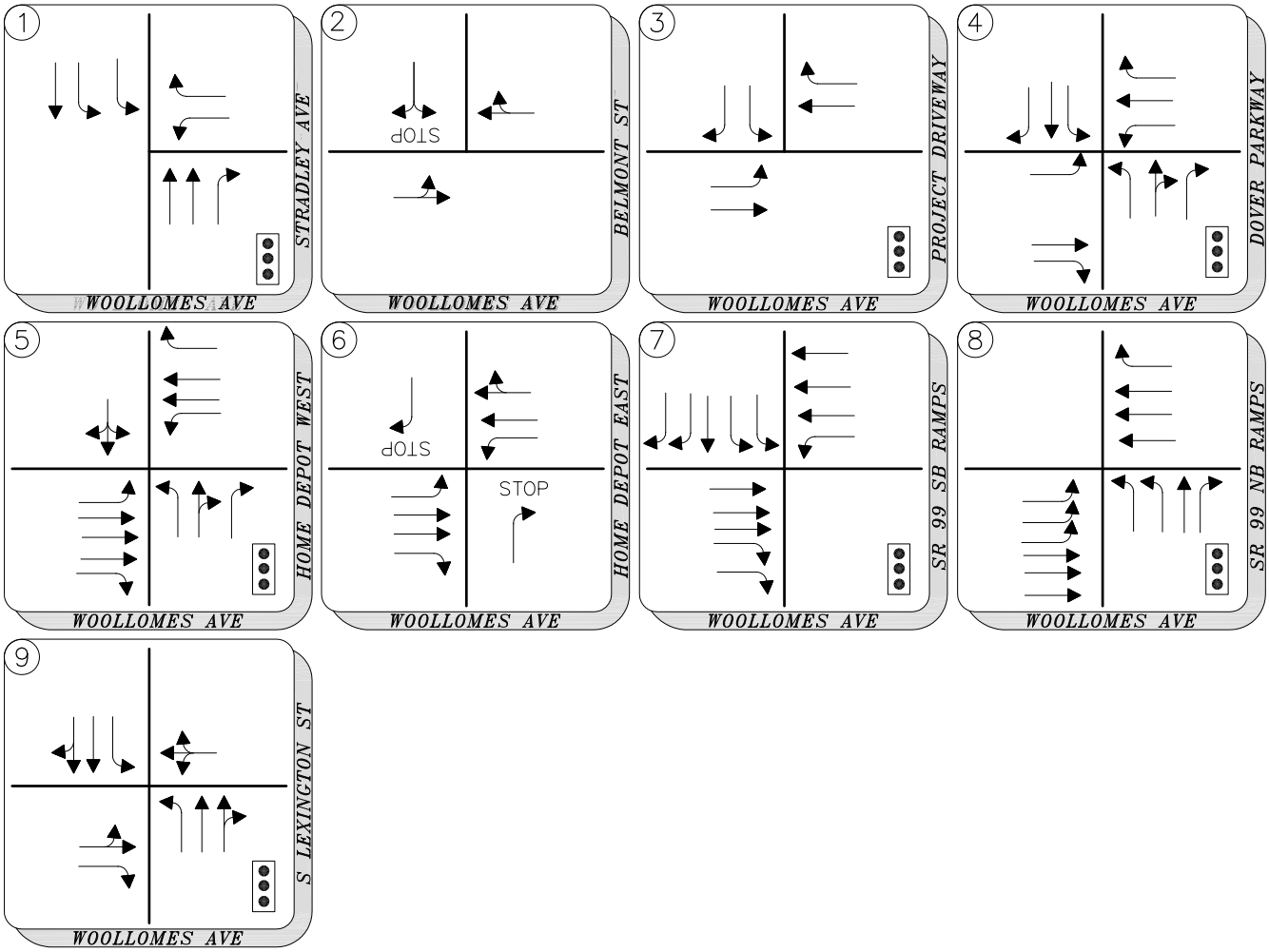

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Figure 10

Cumulative Lane Geometrics and Control Types

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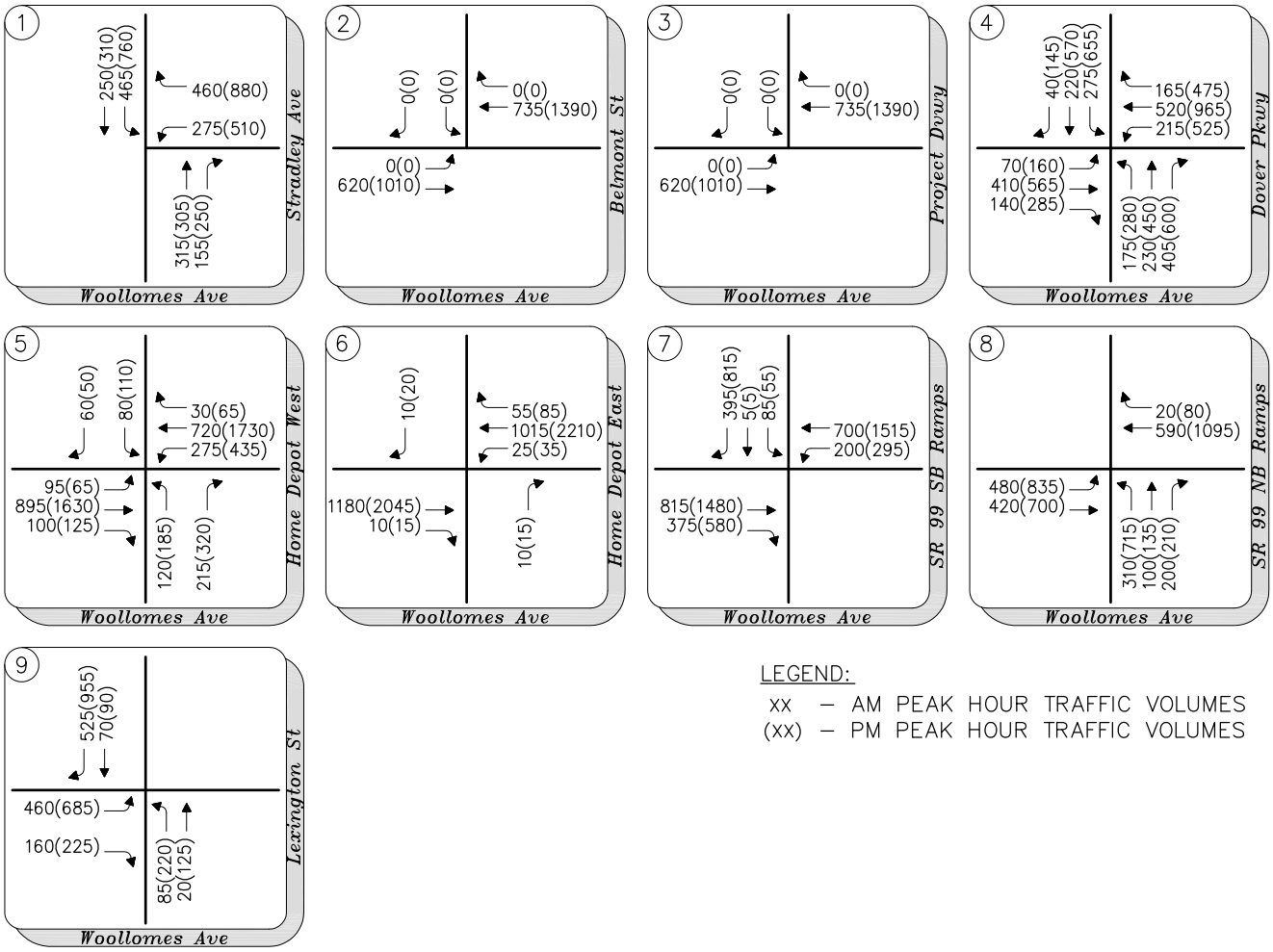

LEGEND:

xx – AM PEAK HOUR TRAFFIC VOLUMES
(xx) – PM PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 11A

Cumulative No Project AM & PM Peak Hour Volumes

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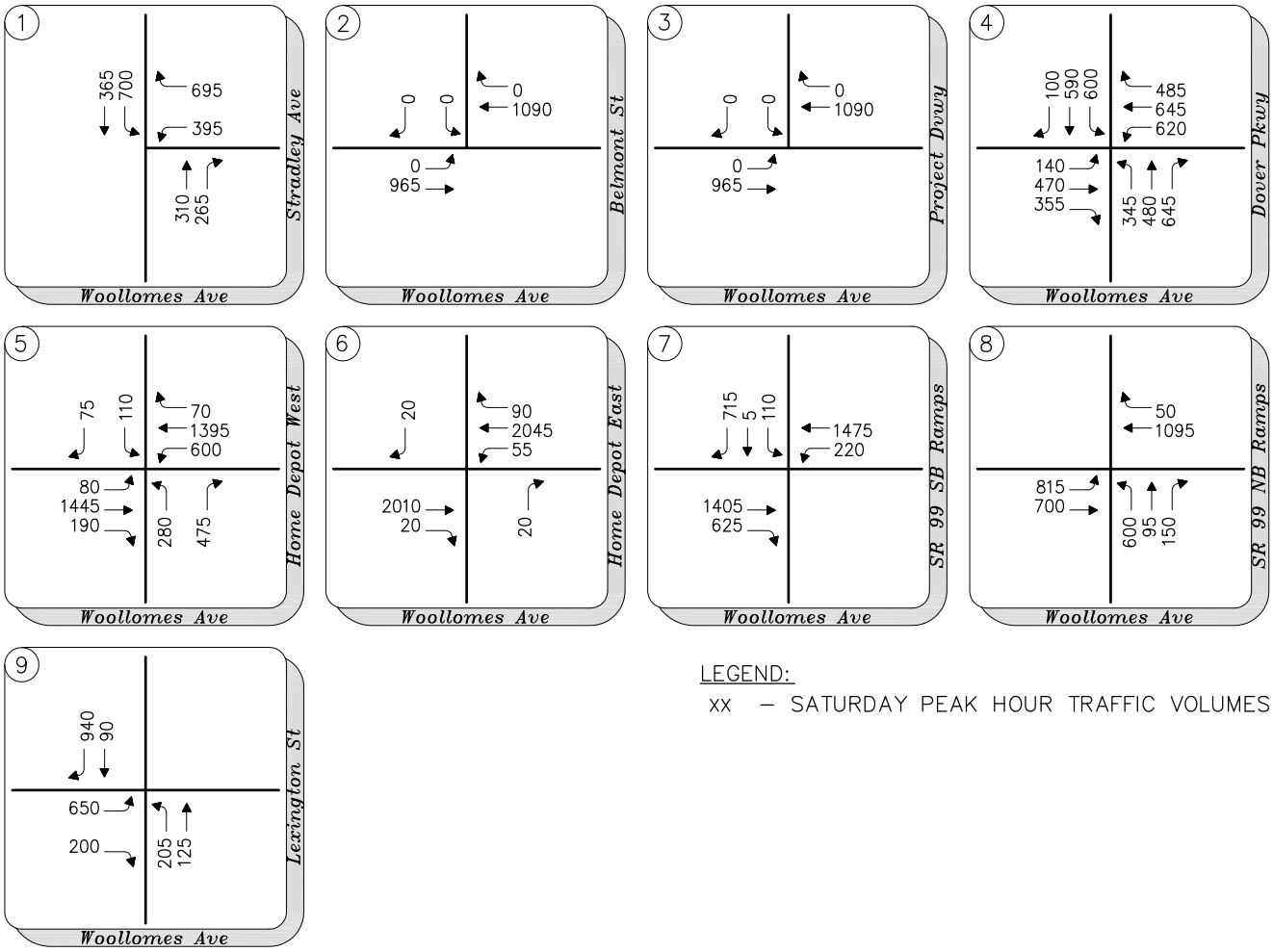

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xx – SATURDAY PEAK HOUR TRAFFIC VOLUMES

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Figure 11B

Cumulative No Project Saturday Peak Hour Volumes

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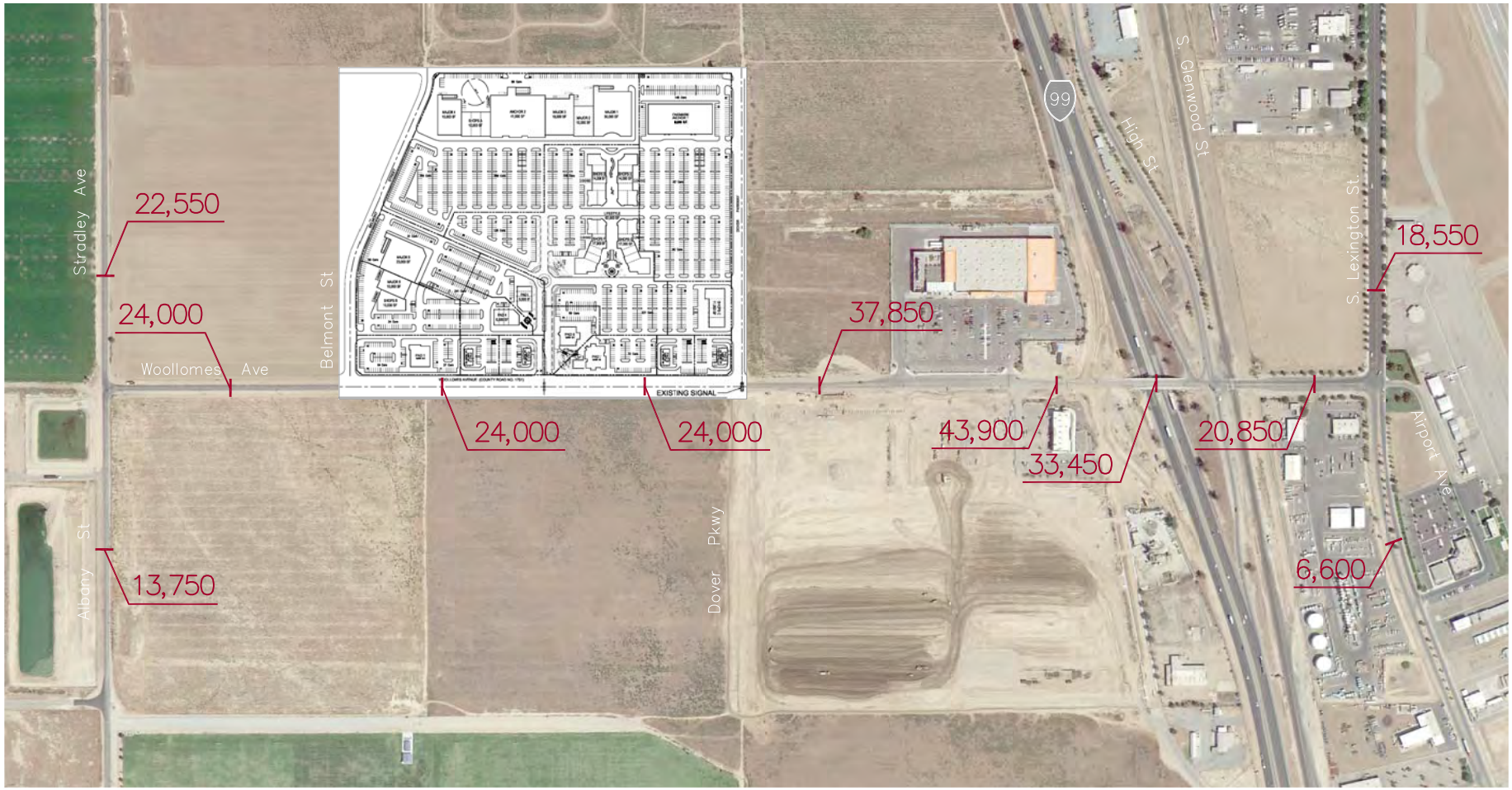

Grapevine Commercial TIAR

Figure 12

Cumulative No Project Daily Roadway Volumes

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Job No: 25-1691-02

CUMULATIVE NO PROJECT TRAFFIC OPERATIONS

Cumulative No Project conditions have been simulated by distributing added traffic generated through build out of vacant general plan land uses (except the proposed project) using the Kern County travel demand model through study intersections. The resulting *Cumulative No Project* traffic volumes are presented in Figures 11A and 11B. *Cumulative No Project* AM, PM, and Saturday peak hour intersection traffic operations have been quantified utilizing *Cumulative Project* lane geometrics and control (Figure 12). Figure 12 presents the *Cumulative No Project* daily roadway volumes. Table 14 contains a summary of the resulting intersection LOS conditions.

TABLE 14
CUMULATIVE NO PROJECT CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	**Woollomes Ave / Stradley Ave**	**Signal**	**D**	20.0	B	**105.3**	**F**	**60.1**	**E**
2	Woollomes Ave / Belmont St	PLUS-PROJECT CONDITIONS ONLY							
3	Woollomes Ave / Project Driveway								
4	**Woollomes Ave / Dover Pkwy**	**Signal**	**D**	51.1	D	**233.9**	**F**	**209.6**	**F**
5	Woollomes Ave / Home Depot West	Signal	D	22.3	C	26.0	C	46.4	D
6	Woollomes Ave / Home Depot East	TWSC	D	13.7	B	28.9	D	25.6	D
7	Woollomes Ave / SR 99 SB Ramps	Signal	D	10.0	A	17.8	B	13.3	B
8	Woollomes Ave / SR 99 NB Ramps	Signal	D	19.9	B	28.9	C	31.8	C
9	**Woollomes Ave / Lexington St**	**Signal**	**D**	**59.0**	**E**	**OVR**	**F**	**OVR**	**F**

Notes:
1. TWSC = Two Way Stop Control *OVR = Delay over 300 Seconds*
2. LOS = Delay based on worst minor street approach for TWSC intersections
3. Warrant = Based on California MUTCD Warrant 3

As presented in Table 14, the Woollomes & Stradley Avenue, Woollomes Avenue & Dover Parkway and Woollomes Avenue & Lexington Street intersections are projected to operate at unacceptable LOS during *Cumulative No Project* conditions. Table 15 presents the *Cumulative No Project* daily roadway segment LOS analysis results.

TABLE 15
CUMULATIVE NO PROJECT CONDITIONS: DAILY ROADWAY LOS

#	Roadway Segment	Capacity Configuration	Target LOS	Cumulative No Project	
				ADT	LOS
1	Woollomes Avenue (Stradley Avenue to Belmont Street)	2-Lane Undivided (<2 signals/mi.)	D	24,000	**E**
2	Woollomes Avenue (Belmont Street to Project Driveway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	24,000	**F**
3	Woollomes Avenue (Project Driveway to Dover Parkway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	24,000	**F**
4	Woollomes Avenue (Dover Parkway to Home Depot East)	6-Lane Divided (>4.5 signals/mi.)	D	37,850	D
5	Woollomes Avenue (Home Depot East to SR 99 SB Ramps)	4-Lane Divided (>4.5 signals/mi.)	D	43,900	**F**
6	Woollomes Avenue (SR 99 SB Ramps to SR 99 NB Ramps)	2-Lane Undivided (>4.5 signals/mi.)	D	33,450	**F**
7	Woollomes Avenue (SR 99 NB Ramps to Lexington Street)	2-Lane Undivided (>4.5 signals/mi.)	D	20,850	**F**
8	Stradley Avenue (north of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	22,550	**E**
9	Stradley Avenue (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	13,750	C
10	Lexington Street (north of Woollomes Avenue)	4-Lane Undivided (<2 signals/mi.)	C	18,550	B
11	Lexington Street (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	6,600	B

Note: Daily Volume estimates based on a .10 to 1 peak hour to daily volume ratio, based on expected changes in new generated traffic in the area.

As presented in Table 15, all segments of Woollomes Avenue are expected to exceed daily capacities in the *Cumulative No Project* conditions, except between Dover Parkway and the Home Depot East driveway. Additionally, the segment of Stradley Avenue just north of Woollomes Avenue is expected to operate at unacceptable LOS. As explained on Pages 26 of this report, under Table 11, impacts and mitigations for this study are based on intersection operations analysis.

SR 99 mainline and ramp merge/diverge operations are presented in Tables 16 and 17 respectively.

TABLE 16
CUMULATIVE NO PROJECT CONDITIONS: MAINLINE LOS

			AM Peak Hour			PM Peak Hour			Saturday Mid-day Peak		
Freeway Mainline Segment	No. Lanes	Target LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln)	LOS	Volume	Density, (pc/mi/ln	LOS
SR 99 NB north of Woollomes Ave	**2**	**C**	**3,130**	**27.5**	**D**	**3,325**	**29.8**	**D**	2,435	20.9	C
SR 99 NB south of Woollomes Ave	**2**	**C**	2,835	24.5	C	**3,695**	**35.0**	**D**	2,630	22.6	C
SR 99 SB north of Woollomes Ave	**2**	**C**	2,480	21.3	C	**3,220**	**28.6**	**D**	2,535	21.7	C
SR 99 SB south of Woollomes Ave	**2**	**C**	2,575	22.1	C	**3,225**	**28.6**	**D**	2,555	21.9	C

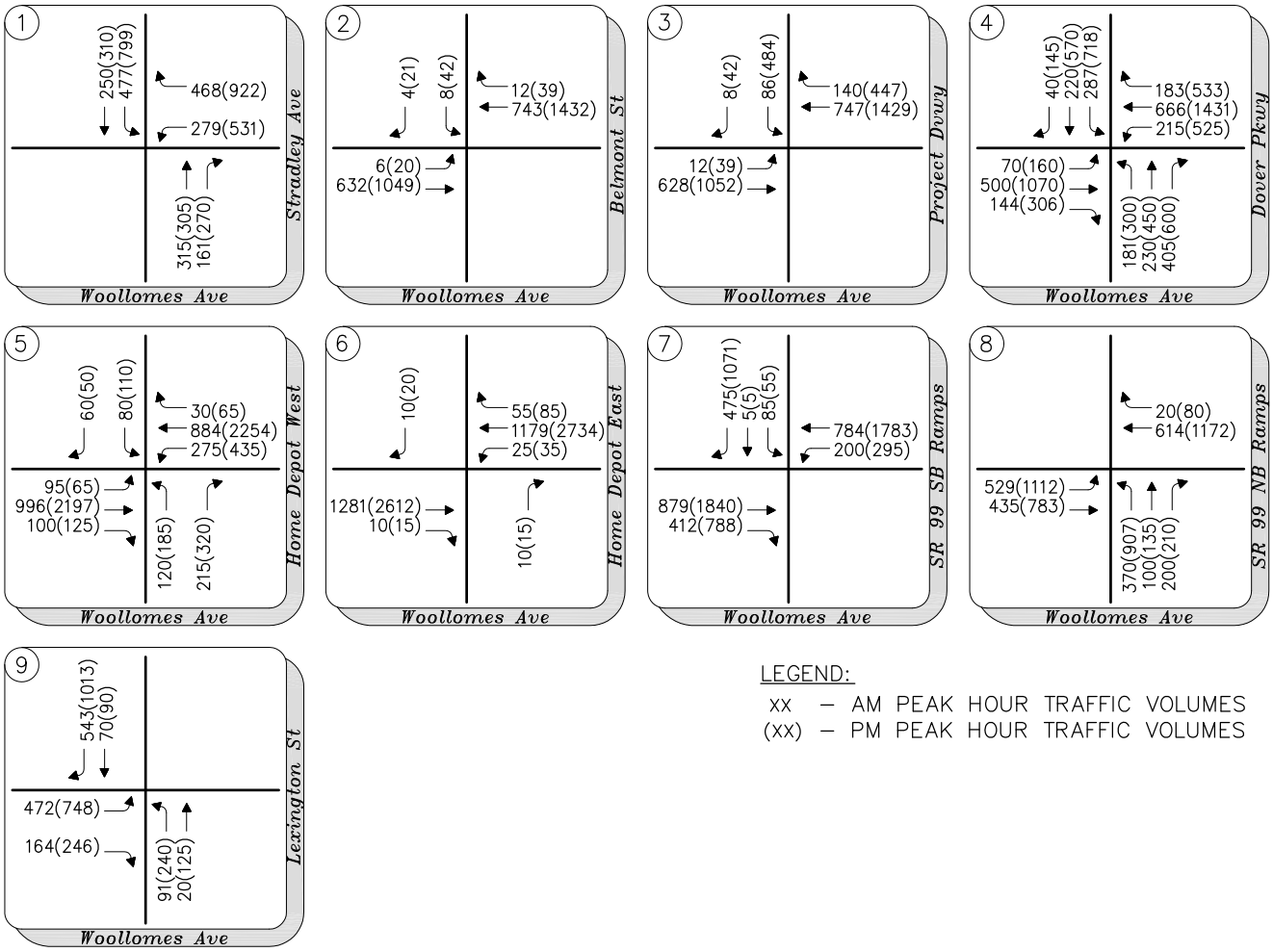
TABLE 17
CUMULATIVE NO PROJECT CONDITIONS: RAMPS LOS

			AM Peak Hour		PM Peak Hour		SAT MID-DAY Peak Hour	
Interchange Location	Target LOS	Junction Type	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
SR 99 Ramps at Woollomes Ave								
SR 99 Northbound On-Ramp	**C**	**Merge**	**30.6**	**D**	**32.3**	**D**	24.7	C
SR 99 Northbound Off-Ramp	**C**	**Diverge**	**29.0**	**D**	**37.1**	**E**	27.1	C
SR 99 Southbound On-Ramp	**C**	**Merge**	26.4	C	**31.9**	**D**	26.1	C
SR 99 Southbound Off-Ramp	**C**	**Diverge**	26.1	C	**33.1**	**D**	26.6	C

As presented in Tables 19 and 20, the freeway mainline is projected to operate at LOS D for the northbound direction, north of Woollomes Avenue in the AM peak hour, and on all study segments in the PM peak hour during *Cumulative No Project* conditions. Similarly, the northbound on and off ramps are expected to operate at LOS D during the AM peak hour, and all ramps are projected to operate at LOS D or worse during the PM peak hour.

CUMULATIVE "PLUS PROJECT" TRAFFIC OPERATIONS

Cumulative Plus Project conditions were developed by adding traffic generated by the proposed project volumes to *Cumulative No Project* intersection traffic volumes. Intersection geometrics assumed for *Cumulative Plus Project* conditions are the same as those assumed for *Cumulative No Project* (Figure 12). Figures 13A and 13B presents the resulting *Cumulative Plus Project* AM, PM, and Saturday peak hour intersection traffic volumes. Table 18 presents the results of the *Cumulative Plus Project* conditions analysis.



LEGEND:

xx – AM PEAK HOUR TRAFFIC VOLUMES
(xx) – PM PEAK HOUR TRAFFIC VOLUMES

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Figure 13A

Cumulative Plus Project AM & PM Peak Hour Volumes

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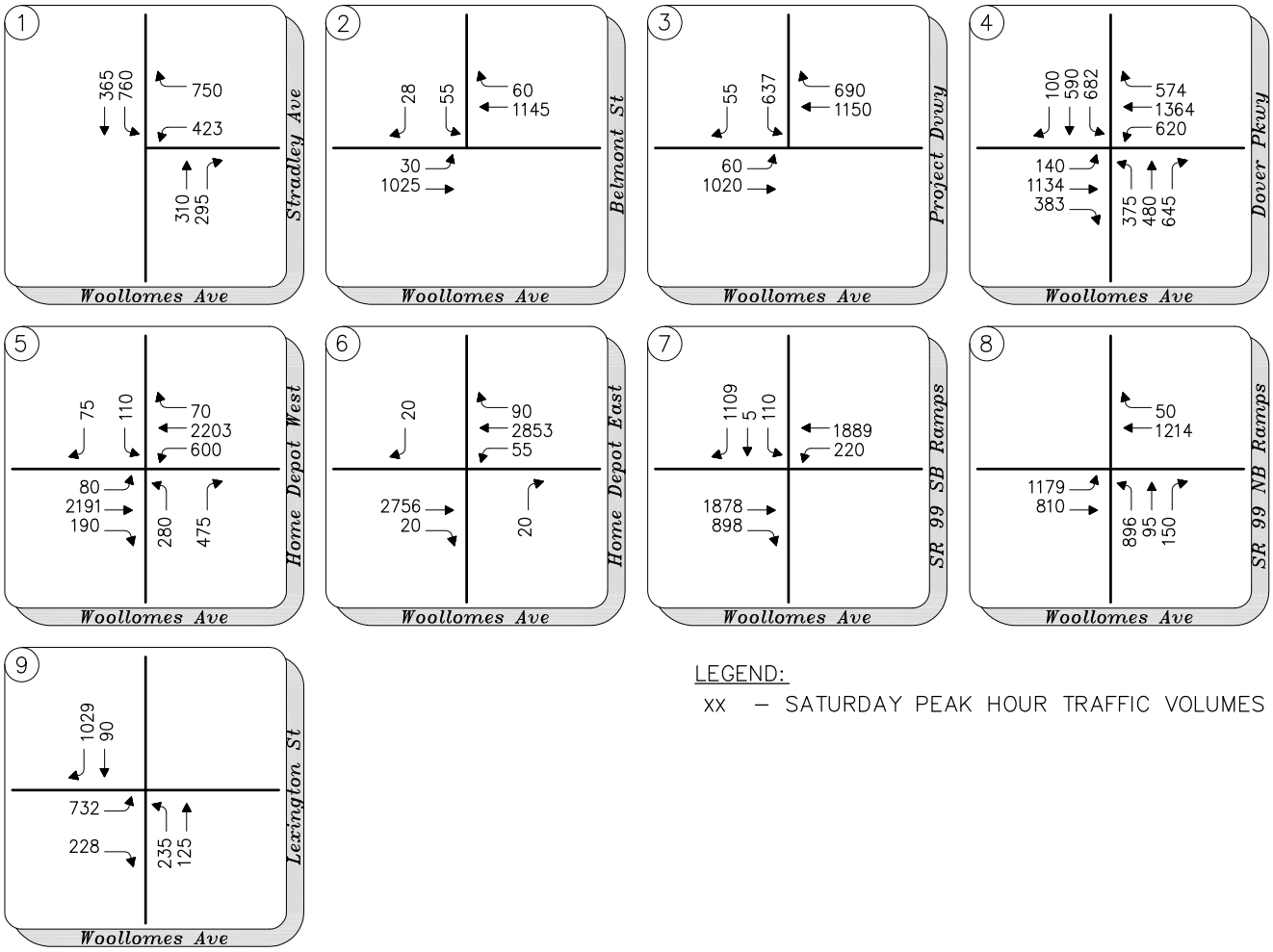

LEGEND:

xx – SATURDAY PEAK HOUR TRAFFIC VOLUMES

Grapevine Commercial TIAR

Figure 13B

Cumulative Plus Project Saturday Peak Hour Volumes

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TABLE 18
CUMULATIVE PLUS PROJECT CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	**Woollomes Ave / Stradley Ave**	**Signal**	**D**	20.8	C	**120.5**	**F**	**79.3**	**E**
2	**Woollomes Ave / Belmont St**	**TWSC**	**D**	28.5	D	**OVR**	**F**	**OVR**	**F**
3	**Woollomes Ave / Project Driveway**	**Signal**	**D**	6.4	A	**100.3**	**F**	**92.0**	**F**
4	**Woollomes Ave / Dover Pkwy**	**Signal**	**D**	**59.8**	**E**	**OVR**	**F**	**OVR**	**F**
5	**Woollomes Ave / Home Depot West**	**Signal**	**D**	21.3	C	**79.6**	**E**	**98.6**	**F**
6	**Woollomes Ave / Home Depot East**	**TWSC**	**D**	14.5	B	**45.0**	**E**	**50.5**	**F**
7	Woollomes Ave / SR 99 SB Ramps	Signal	D	11.3	B	32.7	C	29.6	C
8	Woollomes Ave / SR 99 NB Ramps	Signal	D	22.0	C	35.0	C	34.7	C
9	**Woollomes Ave / Lexington St**	**Signal**	**D**	**66.9**	**E**	**OVR**	**F**	**OVR**	**F**

Notes:
1. TWSC = Two Way Stop Control *OVR = Delay over 300 Seconds*
2. LOS = Delay based on worst minor street approach for TWSC intersections
3. Warrant = Based on California MUTCD Warrant 3

As presented in Table 18, all study intersections are projected to operate at unacceptable LOS during *Cumulative Plus Project* conditions, except SR 99 ramps. Proposed improvements to mitigate these deficiencies are proposed in the final section of this report. Table 19 presents the *Cumulative Plus Project* daily roadway segment LOS analysis results.

TABLE 19
CUMULATIVE PLUS PROJECT CONDITIONS: DAILY ROADWAY LOS

#	Roadway Segment	Capacity Configuration	Target LOS	Project Only Traffic	Cumulative Plus Project	
				DAILY	ADT	LOS
1	Woollomes Avenue (Stradley Avenue to Belmont Street)	2-Lane Undivided (<2 signals/mi.)	D	1,326	25,326	**E**
2	Woollomes Avenue (Belmont Street to Project Driveway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	1,768	25,768	**F**
3	Woollomes Avenue (Project Driveway to Dover Parkway)	2-Lane Undivided (2 to 4.5 signals/mi.)	D	11,184	35,184	**F**
4	Woollomes Avenue (Dover Parkway to Home Depot East)	6-Lane Divided (>4.5 signals/mi.)	D	12,064	49,914	**F**
5	Woollomes Avenue (Home Depot East to SR 99 SB Ramps)	4-Lane Divided (>4.5 signals/mi.)	D	12,064	55,964	**F**
6	Woollomes Avenue (SR 99 SB Ramps to SR 99 NB Ramps)	2-Lane Undivided (>4.5 signals/mi.)	D	6,916	40,366	**F**
7	Woollomes Avenue (SR 99 NB Ramps to Lexington Street)	2-Lane Undivided (>4.5 signals/mi.)	D	1,766	22,616	**F**
8	Stradley Avenue (north of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	884	23,434	**E**
9	Stradley Avenue (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	442	14,192	**D**
10	Lexington Street (north of Woollomes Avenue)	4-Lane Undivided (<2 signals/mi.)	C	1,326	19,876	C
11	Lexington Street (south of Woollomes Avenue)	2-Lane Undivided (<2 signals/mi.)	C	442	7,042	B

Note: Daily Volume estimates based on a .10 to 1 peak hour to daily volume ratio, based on expected changes in new generated traffic in the area.

As presented in Table 19, all segments of Woollomes Avenue are expected to exceed daily capacities in the *Cumulative Plus Project* conditions. Additionally, the segment of Stradley Avenue just north of Woollomes Avenue is expected to operate at unacceptable LOS. As explained on Pages 26 of this report, under Table 11, impacts and mitigations for this study are based on intersection operations analysis.

SR 99 mainline and ramp merge/diverge operations are presented in Tables 20 and 21 respectively.

TABLE 20
CUMULATIVE PLUS PROJECT CONDITIONS: MAINLINE LOS

Freeway Mainline Segment	No. Lanes	Target LOS	AM Peak Hour Volume	AM Peak Hour Density, (pc/mi/ln)	AM Peak Hour LOS	PM Peak Hour Volume	PM Peak Hour Density, (pc/mi/ln)	PM Peak Hour LOS	Saturday Mid-day Peak Volume	Saturday Mid-day Peak Density, (pc/mi/ln	Saturday Mid-day Peak LOS
SR 99 NB north of Woollomes Ave	**2**	**C**	**3,179**	**28.1**	**D**	**3,602**	**33.6**	**D**	2,799	24.1	C
SR 99 NB south of Woollomes Ave	**2**	**C**	2,895	25.1	C	**3,887**	**38.2**	**E**	2,926	25.4	C
SR 99 SB north of Woollomes Ave	**2**	**C**	2,560	21.9	C	**3,476**	**31.8**	**D**	2,929	25.4	C
SR 99 SB south of Woollomes Ave	**2**	**C**	2,612	22.4	C	**3,433**	**31.2**	**D**	2,828	24.4	C

TABLE 21
CUMULATIVE PLUS PROJECT CONDITIONS: RAMPS LOS

Interchange Location	Target LOS	Junction Type	AM Peak Hour Density (pc/mi/ln)	AM Peak Hour LOS	PM Peak Hour Density (pc/mi/ln)	PM Peak Hour LOS	SAT MID-DAY Peak Hour Density (pc/mi/ln)	SAT MID-DAY Peak Hour LOS
SR 99 Ramps at Woollomes Ave								
SR 99 Northbound On-Ramp	**C**	**Merge**	**31.0**	**D**	**34.6**	**D**	27.7	C
SR 99 Northbound Off-Ramp	**C**	**Diverge**	**29.6**	**D**	**38.9**	**E**	**29.9**	**D**
SR 99 Southbound On-Ramp	**C**	**Merge**	26.7	C	**33.5**	**D**	**28.3**	**D**
SR 99 Southbound Off-Ramp	**C**	**Diverge**	26.8	C	**35.5**	**E**	**30.3**	**D**

As presented in Tables 20 and 21, the freeway mainline is projected to operate at LOS D for the northbound direction, north of Woollomes Avenue in the AM peak hour, and at LOS D or worse on all study segments in the PM peak hour during *Cumulative Plus Project* conditions. Similarly, the northbound on and off ramps are expected to operate at LOS D during the AM peak hour, and all ramps are projected to operate at LOS D or worse during the PM peak hour. The southbound on and off ramps and the northbound off ramp are also projected to operate at LOS D during the Saturday peak hour. Interchange improvements that will mitigate these deficiencies are discussed in the final section of this report.

RECOMMENDED IMPROVEMENTS & MITIGATION MEASURES

This section presents recommended improvements that mitigate identified intersection deficiencies in previous sections of this report. Consistent with the following City of Delano policy, mitigations for all intersection in the City of Delano, except for intersections within Caltrans right-of-way, have been designed to achieve LOS D, as they are high volume intersections:

A. Achieve and maintain Level of Service "C" all intersection throughout the City, with the exception of freeway interchanges and high volume intersections where the City's objective is to achieve and maintain Level of Service "D".

Mitigated intersection operations are presented in Tables 22 and 24 for *Existing Plus Project* and *Cumulative Plus Project* respectively. Mitigated intersection lane geometrics are presented in Figures 14 and 15 for *Existing Plus Approved/Pending Projects Plus Project* and *Cumulative Plus Project* respectively.

EXISTING PLUS PROJECT

As previously stated on Page 14, the westbound left turn pocket (at the intersection of Woollomes Avenue & SR 99 SB ramps) needs to be extended by 50 feet, and eastbound left turn pocket (at the intersection of Woollomes Avenue & SR 99 NB ramps) needs to be reduced by 50 feet since they are back-to-back as part of the existing conditions recommended improvements.

The following improvements are recommended to mitigate deficiencies in existing plus project conditions:

Woollomes Avenue / Home Depot East Driveway

Impact

During *Existing Plus Project* conditions, this intersection is projected to operate at unacceptable LOS F for PM and Saturday mid-day peak hour.

Recommended improvement

It is recommended that the existing southbound shared left, through and right turn lane shall be restricted to right turn only. The left turn and through southbound traffic will use the adjacent signalized intersection (Home Depot West). The applicant will be responsible to construct the improvement and the City will be responsible to implement and enforce the recommended improvement. After the construction of the improvement, the intersection is projected to provide acceptable LOS, delay and 95th percentile queue accommodation.

Woollomes Avenue / SR 99 SB Ramps

Impact

During *Existing Plus Project* conditions, this intersection is projected to operate at acceptable LOS D or better, but it is projected to not accommodate 95th percentile queue for southbound right turn movement.

Recommended improvement

It is recommended that the existing southbound shared through and left turn lane shall be converted to a shared right, through and left lane. The project applicant will be responsible to construct the recommended improvement. After the construction of the improvement, the intersection is projected to provide acceptable LOS, delay and 95th percentile queue accommodation.

Woollomes Avenue / SR 99 NB Ramps

Impact

During *Existing Plus Project* conditions, this intersection is projected to operate at acceptable LOS D or better, but it is projected to not accommodate 95th percentile queue for eastbound left turn movement.

Recommended improvement

It is recommended that the existing eastbound through lane shall be converted to a shared through and left lane. The eastbound signal phasing needs to be changed to a split phase. An additional northbound SR 99 on-ramp lane would be required to provide two receiving lanes for the eastbound left turn traffic. The project applicant will be responsible to construct the recommended improvement. After the construction of the improvement, the intersection is projected to provide acceptable LOS, delay and 95th percentile queue accommodation.

TABLE 22
MITIGATED EXISTING PLUS PROJECT CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	Woollomes Ave / Stradley Ave	TWSC	D						
2	Woollomes Ave / Belmont St	TWSC	D						
3	Woollomes Ave / Project Driveway	Signal	D						
4	Woollomes Ave / Dover Pkwy	Signal	D						
5	Woollomes Ave / Home Depot West	Signal	D						
6	Woollomes Ave / Home Depot East	TWSC	D			25.0	C	25.0	C
7	Woollomes Ave / SR 99 SB Ramps	Signal	D						
8	Woollomes Ave / SR 99 NB Ramps	Signal	D						
9	Woollomes Ave / Lexington St	AWSC	D						

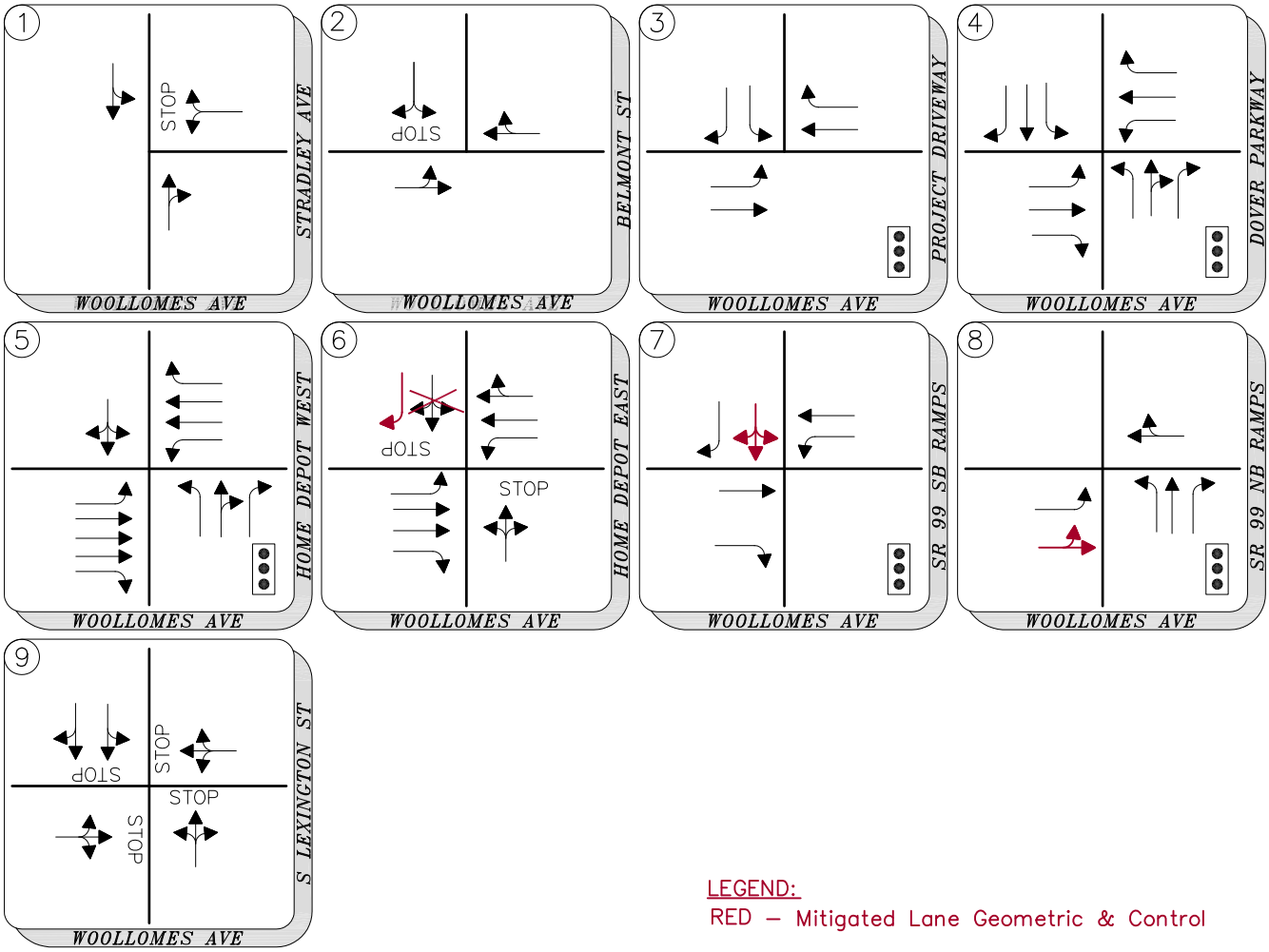
Notes:
1. TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections

TABLE 23
MITIGATED EXISTING PLUS PROJECT CONDITIONS: 95TH PERCENTILE QUEUE

Critical Movement on Woollomes[a]	Storage Length (ft)	95th Percentile Queue (ft)[b]		
		AM	PM	Mid-day Sat
Woollomes Ave / SR 99 SB Ramps				
Eastbound Through	*>600*		344	406
Eastbound Right	*>250*		99	96
Westbound Left[2]	*150*		147	68
Westbound Through	*>450*		196	237
Southbound Left/Through/Right	*>350*		96	102
Southbound Right	*300*		102	157
Woollomes Ave / SR 99 NB Ramps				
Eastbound Left[2]	*225*		183	186
Eastbound Through	*>450*		237	236
Westbound Through/Right	*>500*		320	182
Northbound Left	*300*		203	233
Northbound Through	*>500*		60	38
Northbound Right	*550*		69	54

Notes:
A. Queueing of ramps intersection only shown in this table since those where the only intersections that were projected to experience unacceptable 95th percentile queue in existing plus project conditions.
B. 95th Pecentile Queue Length are determined from five (5) Sim-Traffic Run for each conditions.

As shown in Table 22, all intersections will operate at acceptable LOS and delay after construction of recommended improvements. As shown in Table 23, storage for all movements at closely spaced intersections will accommodate 95th percentile queue with construction of recommended improvements.



LEGEND:
RED – Mitigated Lane Geometric & Control

Grapevine Commercial TIAR

Figure 14

Existing Plus Project Mitigated Lane Geometrics and Control Types

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CUMULATIVE PLUS PROJECT

The improvements for *Cumulative Plus Project* intersections are in addition to those in the previous section. The following improvements are recommended to mitigate deficiencies in these conditions:

Woollomes Avenue / Stradley Avenue

Impact

During *Cumulative Plus Project* conditions, this intersection is projected to operate at LOS F during PM peak hours and Saturday Mid-day Peak hour.

Recommended improvement

It is recommended that additional westbound right lane be constructed (see Figure 15). It is recommended that the project pay fair-share towards the construction of this improvement.

Woollomes Avenue / Belmont Street

Impact

During *Cumulative Plus Project* conditions, this intersection is projected to operate at LOS D during the AM peak hour and at LOS F during the PM and Saturday peak hours.

Recommended improvement

It is recommended that this intersection be signalized and that the eastbound and westbound approaches be widened to two through lanes in each direction, with a dedicated eastbound left turn pocket (see Figure 15). It is recommended that the project pay fair-share towards the construction of this improvement.

Woollomes Avenue / Project Driveway

Impact

During *Cumulative Plus Project* conditions, this intersection is projected to operate at LOS F during the PM and Saturday peak hours.

Recommended improvement

It is recommended that the eastbound and westbound approaches be widened to two through lanes in each direction, with a dedicated eastbound left turn pocket (see Figure 15). It is recommended that the project pay fair-share towards the construction of this improvement.

Woollomes Avenue / Dover Parkway

Impact

During *Cumulative Plus Project* conditions, this intersection is projected to operate at unacceptable LOS during all three peak periods.

Recommended improvement

It is recommended that the eastbound and westbound approaches of this intersection be widened to include dual left turn lanes, dedicated right turn lanes, and three through lanes. The northbound and south approaches should be widened to include dual left turn lanes, two through lanes, and dedicated right turn lanes (see Figure 15). It is recommended that the project pay fair-share towards the construction of this improvement.

Woollomes Avenue / Home Depot West

Impact

During *Cumulative Plus Project* conditions, this intersection is projected to operate at LOS E during the PM peak hour and LOS F during the Saturday peak hour.

Recommended improvement
It is recommended that the eastbound and westbound approaches of this intersection be widened to include dual left turn lanes, dedicated right turn lanes, and three through lanes (see Figure 15). It is recommended that the project pay fair-share towards the construction of this improvement.

Woollomes Avenue / Home Depot East
Impact
During *Cumulative Plus Project* conditions, this intersection is projected to operate at LOS F during the PM and Saturday Mid-day peak hours.

Recommended improvement
It is recommended that eastbound and westbound left turns be prohibited at this intersection and redirected to the next downstream signalized intersection. Additionally, construct an westbound through lane (see Figure 16). It is recommended that the project pay fair-share towards the construction of this improvement.

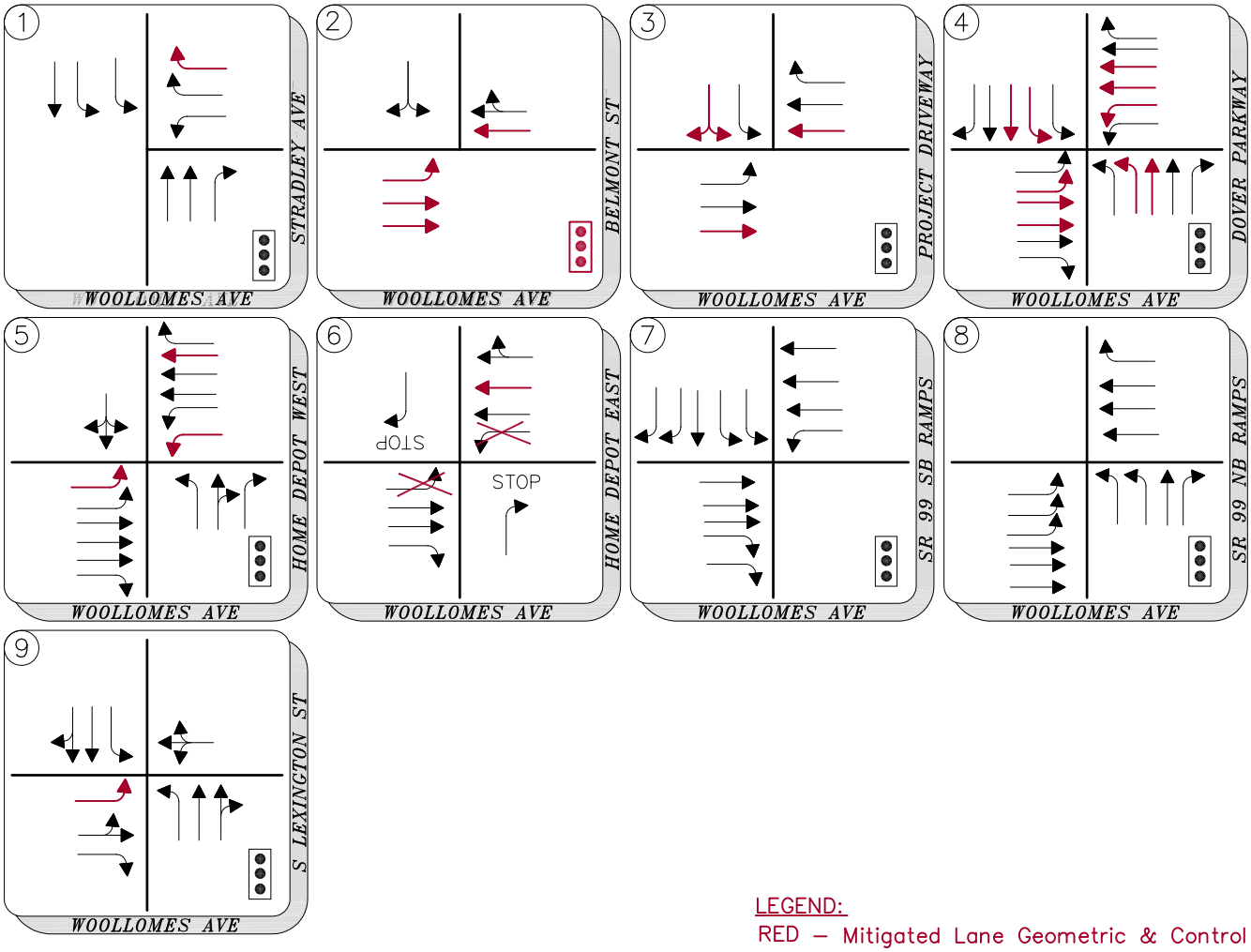
Woollomes Avenue / Lexington Street
Impact
During *Cumulative Plus Project* conditions, this intersection is projected to operate at unacceptable LOS during all three peak periods.

Recommended improvement
It is recommended that second eastbound lane be constructed from the SR 99 NB Ramps to Lexington Street. This lane will become a dedicated left turn lane at the intersection (see Figure 15).

TABLE 24
MITIGATED CUMULATIVE PLUS PROJECT CONDITIONS: INTERSECTION LOS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
				Delay	LOS	Delay	LOS	Delay	LOS
1	Woollomes Ave / Stradley Ave	Signal	D			33.7	C	26.7	C
2	Woollomes Ave / Belmont St	Signal	D			5.3	A	5.8	A
3	Woollomes Ave / Project Driveway	Signal	D			13.7	B	15.9	B
4	Woollomes Ave / Dover Pkwy	Signal	D	22.0	C	51.8	D	37.2	D
5	Woollomes Ave / Home Depot West	Signal	D			19.6	B	42.1	D
6	Woollomes Ave / Home Depot East	TWSC	D			11.8	B	13.8	B
7	Woollomes Ave / SR 99 SB Ramps	Signal	C						
8	Woollomes Ave / SR 99 NB Ramps	Signal	C						
9	Woollomes Ave / Lexington St	Signal	D	20.6	C	44.3	D	42.1	D

Notes:
1. TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections



LEGEND:
RED – Mitigated Lane Geometric & Control

Grapevine Commercial TIAR

Figure 15

Cumulative Plus Project Mitigated Lane Geometrics and Control Types

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MITIGATED DAILY ROADWAY OPERATION

No mitigated daily roadway analysis has been prepared for this report because roadway capacity is defined by intersection operations along a given corridor. As previously mentioned in this report, daily capacity analysis was used to preliminarily identify potential areas of congestion on a roadway segment basis. However, project impacts and mitigation measures are defined by intersection operations analysis. Provided the proposed improvements are constructed, and intersection operations are rendered acceptable, project impacts and projected deficiencies will be considered mitigated.

SR 99 RAMP AND MAINLINE IMPROVEMENTS

The *Cumulative No Project* and *Cumulative Plus Project* ramp and mainline analyses indicated significant deficiencies on both the SR 99 mainline and ramps. Reconfiguration of the Woollomes Avenue/SR 99 interchange, including improvements to the ramps, is included in the City's existing capital improvement plan and funded by the City's existing TIF. The project will contribute its fair share to the interchange reconfiguration in accordance with the City's existing improvement plan and TIF. Improvements of the SR 99 mainline and ramps beyond the interchange project are within the jurisdiction of Caltrans and outside the purview of the City.

APPENDIX

Synchro Level Of Service Reports

Sim-Traffic Operation & Queuing Reports

HCS Level of Service Reports

Synchro Level Of Service Reports

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Intersection	
Int Delay, s/veh	5.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	13	65	26	14	40	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	9	9	9	9	9	9
Mvmt Flow	14	68	27	15	42	17

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	136	35	0	0	42	0
Stage 1	35	-	-	-	-	-
Stage 2	101	-	-	-	-	-
Critical Hdwy	6.49	6.29	-	-	4.19	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-	-
Follow-up Hdwy	3.581	3.381	-	-	2.281	-
Pot Cap-1 Maneuver	841	1018	-	-	1523	-
Stage 1	970	-	-	-	-	-
Stage 2	906	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	817	1018	-	-	1523	-
Mov Cap-2 Maneuver	817	-	-	-	-	-
Stage 1	970	-	-	-	-	-
Stage 2	881	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0	5.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	978	1523	-
HCM Lane V/C Ratio	-	-	0.084	0.028	-
HCM Control Delay (s)	-	-	9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	126	3	15	176	60	9	1	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	7	7	7	7	7	7	7	7	7
Mvmt Flow	7	131	3	16	183	62	9	1	4

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	246	0	0	131	0	0	269	423	66
Stage 1	-	-	-	-	-	-	146	146	-
Stage 2	-	-	-	-	-	-	123	277	-
Critical Hdwy	4.24	-	-	4.24	-	-	7.64	6.64	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.64	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.64	-
Follow-up Hdwy	2.27	-	-	2.27	-	-	3.57	4.07	3.37
Pot Cap-1 Maneuver	1281	-	-	1416	-	-	649	510	968
Stage 1	-	-	-	-	-	-	827	763	-
Stage 2	-	-	-	-	-	-	854	668	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1281	-	-	1416	-	-	632	501	968
Mov Cap-2 Maneuver	-	-	-	-	-	-	632	501	-
Stage 1	-	-	-	-	-	-	822	759	-
Stage 2	-	-	-	-	-	-	832	660	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	0.5	10.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	687	1281	-	-	1416	-	-	624
HCM Lane V/C Ratio	0.021	0.006	-	-	0.011	-	-	0.087
HCM Control Delay (s)	10.4	7.8	-	-	7.6	-	-	11.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.3

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	40	1	11
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	96	96	96
Heavy Vehicles, %	7	7	7
Mvmt Flow	42	1	11

Major/Minor	Minor2		
Conflicting Flow All	327	392	123
Stage 1	246	246	-
Stage 2	81	146	-
Critical Hdwy	7.64	6.64	7.04
Critical Hdwy Stg 1	6.64	5.64	-
Critical Hdwy Stg 2	6.64	5.64	-
Follow-up Hdwy	3.57	4.07	3.37
Pot Cap-1 Maneuver	590	531	889
Stage 1	722	689	-
Stage 2	904	763	-
Platoon blocked, %			
Mov Cap-1 Maneuver	579	522	889
Mov Cap-2 Maneuver	579	522	-
Stage 1	718	681	-
Stage 2	894	759	-

Approach	SB
HCM Control Delay, s	11.3
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Intersection Delay, s/veh	10.2
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	170	1	106	0	0	0	1	0	50	28	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	9	9	9	2	9	9	9	2	9	9	9
Mvmt Flow	0	185	1	115	0	0	0	1	0	54	30	8
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	11.1	7.8	9.2
HCM LOS	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	59%	61%	0%	8%	0%
Vol Thru, %	33%	0%	0%	92%	18%
Vol Right, %	8%	38%	100%	0%	82%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	85	277	1	39	200
LT Vol	28	1	0	36	36
Through Vol	7	106	1	0	164
RT Vol	50	170	0	3	0
Lane Flow Rate	92	301	1	42	217
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.136	0.401	0.001	0.065	0.298
Departure Headway (Hd)	5.298	4.798	4.708	5.545	4.928
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	673	747	752	644	726
Service Time	3.362	2.846	2.785	3.298	2.681
HCM Lane V/C Ratio	0.137	0.403	0.001	0.065	0.299
HCM Control Delay	9.2	11.1	7.8	8.7	9.8
HCM Lane LOS	A	B	A	A	A
HCM 95th-tile Q	0.5	1.9	0	0.2	1.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	3	72	164
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	9	9	9
Mvmt Flow	0	3	78	178
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	9.6
HCM LOS	A

Lane

Intersection	
Int Delay, s/veh	6.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	26	121	70	13	85	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	132	76	14	92	29

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	297	83	0	0	90	0
Stage 1	83	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	694	976	-	-	1505	-
Stage 1	940	-	-	-	-	-
Stage 2	822	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	651	976	-	-	1505	-
Mov Cap-2 Maneuver	651	-	-	-	-	-
Stage 1	940	-	-	-	-	-
Stage 2	771	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.9	0	5.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	897	1505	-
HCM Lane V/C Ratio	-	-	0.178	0.061	-
HCM Control Delay (s)	-	-	9.9	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0.2	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	8	277	4	15	302	60	6	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	295	4	16	321	64	6	0	13

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	385	0	0	295	0	0	505	729	147
Stage 1	-	-	-	-	-	-	312	312	-
Stage 2	-	-	-	-	-	-	193	417	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	1170	-	-	1263	-	-	450	348	873
Stage 1	-	-	-	-	-	-	673	656	-
Stage 2	-	-	-	-	-	-	790	590	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1170	-	-	1263	-	-	436	341	873
Mov Cap-2 Maneuver	-	-	-	-	-	-	436	341	-
Stage 1	-	-	-	-	-	-	668	651	-
Stage 2	-	-	-	-	-	-	767	583	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.3	10.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	654	1170	-	-	1263	-	-	449
HCM Lane V/C Ratio	0.029	0.007	-	-	0.013	-	-	0.161
HCM Control Delay (s)	10.7	8.1	-	-	7.9	-	-	14.6
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.6

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	55	0	13
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	94	94	94
Heavy Vehicles, %	2	2	2
Mvmt Flow	59	0	14

Major/Minor	Minor2		
Conflicting Flow All	549	697	193
Stage 1	385	385	-
Stage 2	164	312	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	419	363	816
Stage 1	610	609	-
Stage 2	822	656	-
Platoon blocked, %			
Mov Cap-1 Maneuver	406	356	816
Mov Cap-2 Maneuver	406	356	-
Stage 1	605	601	-
Stage 2	804	651	-

Approach	SB
HCM Control Delay, s	14.6
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	255	7	52	0	0	0	0	0	145	71	3
Peak Hour Factor	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	4	4	4	2	4	4	4	2	4	4	4
Mvmt Flow	0	304	8	62	0	0	0	0	0	173	85	4
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	16.1	0	13
HCM LOS	C	-	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	66%	81%	0%	19%	0%
Vol Thru, %	32%	2%	100%	81%	12%
Vol Right, %	1%	17%	0%	0%	88%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	219	314	0	36	234
LT Vol	71	7	0	29	29
Through Vol	3	52	0	0	205
RT Vol	145	255	0	7	0
Lane Flow Rate	261	374	0	43	279
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.421	0.579	0	0.074	0.422
Departure Headway (Hd)	5.808	5.58	6.314	6.18	5.459
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	621	647	0	579	660
Service Time	3.848	3.617	4.38	3.921	3.199
HCM Lane V/C Ratio	0.42	0.578	0	0.074	0.423
HCM Control Delay	13	16.1	9.4	9.4	12.2
HCM Lane LOS	B	C	N	A	B
HCM 95th-tile Q	2.1	3.7	0	0.2	2.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	7	58	205
Peak Hour Factor	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	4	4	4
Mvmt Flow	0	8	69	244
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.8
HCM LOS	B

Lane

Intersection	
Int Delay, s/veh	6.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	30	123	43	30	89	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	134	47	33	97	45

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	301	63	0	0	79	0
Stage 1	63	-	-	-	-	-
Stage 2	238	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	691	1002	-	-	1519	-
Stage 1	960	-	-	-	-	-
Stage 2	802	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	646	1002	-	-	1519	-
Mov Cap-2 Maneuver	646	-	-	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	750	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.9	0	5.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	904	1519	-
HCM Lane V/C Ratio	-	-	0.184	0.064	-
HCM Control Delay (s)	-	-	9.9	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.7	0.2	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	310	0	4	318	65	2	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	326	0	4	335	68	2	0	12

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	403	0	0	326	0	0	521	757	163
Stage 1	-	-	-	-	-	-	345	345	-
Stage 2	-	-	-	-	-	-	176	412	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	1152	-	-	1230	-	-	438	335	853
Stage 1	-	-	-	-	-	-	644	635	-
Stage 2	-	-	-	-	-	-	809	593	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1152	-	-	1230	-	-	424	331	853
Mov Cap-2 Maneuver	-	-	-	-	-	-	424	331	-
Stage 1	-	-	-	-	-	-	639	630	-
Stage 2	-	-	-	-	-	-	787	591	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.1	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	738	1152	-	-	1230	-	-	449
HCM Lane V/C Ratio	0.019	0.008	-	-	0.003	-	-	0.206
HCM Control Delay (s)	10	8.2	-	-	7.9	-	-	15.1
HCM Lane LOS	B	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.8

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	70	0	18
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	95	95	95
Heavy Vehicles, %	2	2	2
Mvmt Flow	74	0	19

Major/Minor	Minor2		
Conflicting Flow All	559	722	202
Stage 1	377	377	-
Stage 2	182	345	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	412	351	805
Stage 1	616	614	-
Stage 2	802	635	-
Platoon blocked, %			
Mov Cap-1 Maneuver	403	347	805
Mov Cap-2 Maneuver	403	347	-
Stage 1	611	612	-
Stage 2	785	630	-

Approach	SB
HCM Control Delay, s	15.1
HCM LOS	C

Minor Lane/Major Mvmt

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	192	5	43	0	0	1	0	0	35	32	2
Peak Hour Factor	0.92	0.83	0.83	0.83	0.92	0.83	0.83	0.83	0.92	0.83	0.83	0.83
Heavy Vehicles, %	2	6	6	6	2	6	6	6	2	6	6	6
Mvmt Flow	0	231	6	52	0	0	1	0	0	42	39	2
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	10.8	8.2	8.9
HCM LOS	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	51%	80%	0%	25%	0%
Vol Thru, %	46%	2%	100%	75%	10%
Vol Right, %	3%	18%	0%	0%	90%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	69	240	1	20	157
LT Vol	32	5	1	15	15
Through Vol	2	43	0	0	142
RT Vol	35	192	0	5	0
Lane Flow Rate	83	289	1	24	189
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.119	0.383	0.002	0.037	0.251
Departure Headway (Hd)	5.174	4.767	5.09	5.542	4.778
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	690	755	699	645	749
Service Time	3.225	2.806	3.152	3.285	2.52
HCM Lane V/C Ratio	0.12	0.383	0.001	0.037	0.252
HCM Control Delay	8.9	10.8	8.2	8.5	9.1
HCM Lane LOS	A	B	A	A	A
HCM 95th-tile Q	0.4	1.8	0	0.1	1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	5	30	142
Peak Hour Factor	0.92	0.83	0.83	0.83
Heavy Vehicles, %	2	6	6	6
Mvmt Flow	0	6	36	171
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	9
HCM LOS	A

Lane

Intersection	
Int Delay, s/veh	6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	17	73	26	20	52	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	9	9	9	9	9	9
Mvmt Flow	18	77	27	21	55	17

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	164	38	0	0	48	0
Stage 1	38	-	-	-	-	-
Stage 2	126	-	-	-	-	-
Critical Hdwy	6.49	6.29	-	-	4.19	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-	-
Follow-up Hdwy	3.581	3.381	-	-	2.281	-
Pot Cap-1 Maneuver	811	1014	-	-	1515	-
Stage 1	967	-	-	-	-	-
Stage 2	883	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	781	1014	-	-	1515	-
Mov Cap-2 Maneuver	781	-	-	-	-	-
Stage 1	967	-	-	-	-	-
Stage 2	850	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	5.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	960	1515	-
HCM Lane V/C Ratio	-	-	0.099	0.036	-
HCM Control Delay (s)	-	-	9.2	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	12	60	82	6	4	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	65	89	7	4	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	96	0	-	0	183	92
Stage 1	-	-	-	-	92	-
Stage 2	-	-	-	-	91	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1498	-	-	-	806	965
Stage 1	-	-	-	-	932	-
Stage 2	-	-	-	-	933	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1498	-	-	-	799	965
Mov Cap-2 Maneuver	-	-	-	-	799	-
Stage 1	-	-	-	-	932	-
Stage 2	-	-	-	-	925	-

Approach	EB	WB	SB
HCM Control Delay, s	1.2	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1498	-	-	-	902
HCM Lane V/C Ratio	0.009	-	-	-	0.014
HCM Control Delay (s)	7.4	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	6	58	84	100	62	4
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	176.5	186.3	186.3	186.3	176.5	186.3
Adj Flow Rate, veh/h	7	63	91	109	67	4
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	13	696	293	249	351	331
Arrive On Green	0.01	0.37	0.16	0.16	0.21	0.21
Sat Flow, veh/h	1681	1863	1863	1583	1681	1583
Grp Volume(v), veh/h	7	63	91	109	67	4
Grp Sat Flow(s),veh/h/ln	1681	1863	1863	1583	1681	1583
Q Serve(g_s), s	0.1	0.4	0.8	1.2	0.6	0.0
Cycle Q Clear(g_c), s	0.1	0.4	0.8	1.2	0.6	0.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	13	696	293	249	351	331
V/C Ratio(X)	0.55	0.09	0.31	0.44	0.19	0.01
Avail Cap(c_a), veh/h	526	3014	2042	1735	1842	1735
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.5	3.9	7.2	7.3	6.2	6.0
Incr Delay (d2), s/veh	31.5	0.1	0.6	1.2	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.2	0.5	0.6	0.3	0.0
LnGrp Delay(d),s/veh	41.0	3.9	7.7	8.5	6.5	6.0
LnGrp LOS	D	A	A	A	A	A
Approach Vol, veh/h		70	200		71	
Approach Delay, s/veh		7.7	8.2		6.5	
Approach LOS		A	A		A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				11.2		8.0	4.1	7.0
Change Period (Y+Rc), s				4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s				31.0		21.0	6.0	21.0
Max Q Clear Time (g_c+I1), s				2.4		2.6	2.1	3.2
Green Ext Time (p_c), s				0.3		0.1	0.1	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	7.7
HCM 2010 LOS	A

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	227	3	15	340	60	9	1	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	7	7	7	7	7	7	7	7	7
Mvmt Flow	7	236	3	16	354	62	9	1	4

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	417	0	0	236	0	0	460	699	118
Stage 1	-	-	-	-	-	-	251	251	-
Stage 2	-	-	-	-	-	-	209	448	-
Critical Hdwy	4.24	-	-	4.24	-	-	7.64	6.64	7.04
Critical Hdwy Stg 1	-	-	-	-	-	-	6.64	5.64	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.64	5.64	-
Follow-up Hdwy	2.27	-	-	2.27	-	-	3.57	4.07	3.37
Pot Cap-1 Maneuver	1104	-	-	1293	-	-	473	352	896
Stage 1	-	-	-	-	-	-	717	686	-
Stage 2	-	-	-	-	-	-	759	559	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1104	-	-	1293	-	-	458	345	896
Mov Cap-2 Maneuver	-	-	-	-	-	-	458	345	-
Stage 1	-	-	-	-	-	-	712	682	-
Stage 2	-	-	-	-	-	-	737	552	-

Approach	EB	WB	NB
HCM Control Delay, s	0.2	0.3	12.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	518	1104	-	-	1293	-	-	443
HCM Lane V/C Ratio	0.028	0.007	-	-	0.012	-	-	0.122
HCM Control Delay (s)	12.2	8.3	-	-	7.8	-	-	14.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.4

Intersection	
Intersection Delay, s/veh	10.5
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	174	1	110	0	0	0	1	0	56	28	7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	9	9	9	2	9	9	9	2	9	9	9
Mvmt Flow	0	189	1	120	0	0	0	1	0	61	30	8
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	11.4	7.9	9.4
HCM LOS	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	62%	61%	0%	8%	0%
Vol Thru, %	31%	0%	0%	92%	17%
Vol Right, %	8%	39%	100%	0%	83%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	91	285	1	39	218
LT Vol	28	1	0	36	36
Through Vol	7	110	1	0	182
RT Vol	56	174	0	3	0
Lane Flow Rate	99	310	1	42	237
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.147	0.418	0.001	0.066	0.326
Departure Headway (Hd)	5.361	4.858	4.794	5.583	4.955
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	664	737	737	638	720
Service Time	3.434	2.911	2.882	3.343	2.715
HCM Lane V/C Ratio	0.149	0.421	0.001	0.066	0.329
HCM Control Delay	9.4	11.4	7.9	8.7	10.1
HCM Lane LOS	A	B	A	A	B
HCM 95th-tile Q	0.5	2.1	0	0.2	1.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	3	72	182
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	9	9	9
Mvmt Flow	0	3	78	198
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	9.9
HCM LOS	A

Lane

Intersection	
Int Delay, s/veh	7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	47	163	70	33	124	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	51	177	76	36	135	29

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	393	94	0	0	112	0
Stage 1	94	-	-	-	-	-
Stage 2	299	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	611	963	-	-	1478	-
Stage 1	930	-	-	-	-	-
Stage 2	752	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	554	963	-	-	1478	-
Mov Cap-2 Maneuver	554	-	-	-	-	-
Stage 1	930	-	-	-	-	-
Stage 2	682	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11	0	6.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	826	1478	-
HCM Lane V/C Ratio	-	-	0.276	0.091	-
HCM Control Delay (s)	-	-	11	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0.3	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	39	118	167	20	21	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	128	182	22	23	46

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	203	0	-	0	405	192
Stage 1	-	-	-	-	192	-
Stage 2	-	-	-	-	213	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1369	-	-	-	602	850
Stage 1	-	-	-	-	841	-
Stage 2	-	-	-	-	823	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1369	-	-	-	582	850
Mov Cap-2 Maneuver	-	-	-	-	582	-
Stage 1	-	-	-	-	841	-
Stage 2	-	-	-	-	796	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1369	-	-	-	737
HCM Lane V/C Ratio	0.031	-	-	-	0.093
HCM Control Delay (s)	7.7	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	20	119	166	320	346	21
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	176.5	186.3	186.3	186.3	176.5	186.3
Adj Flow Rate, veh/h	22	129	180	348	376	23
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	37	862	595	506	496	468
Arrive On Green	0.02	0.46	0.32	0.32	0.30	0.30
Sat Flow, veh/h	1681	1863	1863	1583	1681	1583
Grp Volume(v), veh/h	22	129	180	348	376	23
Grp Sat Flow(s),veh/h/ln	1681	1863	1863	1583	1681	1583
Q Serve(g_s), s	0.4	1.3	2.4	6.3	6.7	0.3
Cycle Q Clear(g_c), s	0.4	1.3	2.4	6.3	6.7	0.3
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	37	862	595	506	496	468
V/C Ratio(X)	0.59	0.15	0.30	0.69	0.76	0.05
Avail Cap(c_a), veh/h	204	1579	1128	959	1221	1150
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.0	5.1	8.5	9.8	10.6	8.3
Incr Delay (d2), s/veh	14.1	0.1	0.3	1.7	2.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.7	1.2	2.9	3.4	0.4
LnGrp Delay(d),s/veh	30.1	5.2	8.8	11.5	13.0	8.4
LnGrp LOS	C	A	A	B	B	A
Approach Vol, veh/h		151	528		399	
Approach Delay, s/veh		8.8	10.6		12.7	
Approach LOS		A	B		B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				19.3		13.8	4.7	14.5
Change Period (Y+Rc), s				4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s				28.0		24.0	4.0	20.0
Max Q Clear Time (g_c+I1), s				3.3		8.7	2.4	8.3
Green Ext Time (p_c), s				2.8		1.0	0.0	2.2

Intersection Summary	
HCM 2010 Ctrl Delay	11.1
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	8	844	4	15	826	60	6	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	898	4	16	879	64	6	0	13

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	943	0	0	898	0	0	1386	1889	449
Stage 1	-	-	-	-	-	-	915	915	-
Stage 2	-	-	-	-	-	-	471	974	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	723	-	-	752	-	-	102	70	557
Stage 1	-	-	-	-	-	-	294	350	-
Stage 2	-	-	-	-	-	-	542	328	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	723	-	-	752	-	-	97	68	557
Mov Cap-2 Maneuver	-	-	-	-	-	-	97	68	-
Stage 1	-	-	-	-	-	-	290	346	-
Stage 2	-	-	-	-	-	-	517	321	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.2	23.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	216	723	-	-	752	-	-	112
HCM Lane V/C Ratio	0.089	0.012	-	-	0.021	-	-	0.646
HCM Control Delay (s)	23.3	10	-	-	9.9	-	-	82.7
HCM Lane LOS	C	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	3.3

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	55	0	13
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	94	94	94
Heavy Vehicles, %	2	2	2
Mvmt Flow	59	0	14

Major/Minor	Minor2		
Conflicting Flow All	1409	1858	471
Stage 1	943	943	-
Stage 2	466	915	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	99	73	539
Stage 1	282	339	-
Stage 2	546	350	-
Platoon blocked, %			
Mov Cap-1 Maneuver	94	71	539
Mov Cap-2 Maneuver	94	71	-
Stage 1	278	332	-
Stage 2	527	346	-

Approach	SB
HCM Control Delay, s	82.7
HCM LOS	F

Minor Lane/Major Mvmt

Intersection	
Intersection Delay, s/veh	17.2
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	276	7	73	0	0	0	0	0	165	71	3
Peak Hour Factor	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	4	4	4	2	4	4	4	2	4	4	4
Mvmt Flow	0	329	8	87	0	0	0	0	0	196	85	4
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	20.8	0	15
HCM LOS	C	-	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	69%	78%	0%	19%	0%
Vol Thru, %	30%	2%	100%	81%	10%
Vol Right, %	1%	21%	0%	0%	90%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	239	356	0	36	292
LT Vol	71	7	0	29	29
Through Vol	3	73	0	0	263
RT Vol	165	276	0	7	0
Lane Flow Rate	285	424	0	43	348
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.487	0.687	0	0.077	0.553
Departure Headway (Hd)	6.16	5.834	6.958	6.468	5.727
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	583	619	0	551	626
Service Time	4.231	3.893	4.958	4.237	3.495
HCM Lane V/C Ratio	0.489	0.685	0	0.078	0.556
HCM Control Delay	15	20.8	10	9.8	15.4
HCM Lane LOS	B	C	N	A	C
HCM 95th-tile Q	2.7	5.4	0	0.2	3.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	7	58	263
Peak Hour Factor	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	4	4	4
Mvmt Flow	0	8	69	313
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	14.8
HCM LOS	B

Lane

Intersection	
Int Delay, s/veh	7.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	58	178	43	60	149	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	63	193	47	65	162	45

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	447	79	0	0	112	0
Stage 1	79	-	-	-	-	-
Stage 2	368	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	569	981	-	-	1478	-
Stage 1	944	-	-	-	-	-
Stage 2	700	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	505	981	-	-	1478	-
Mov Cap-2 Maneuver	505	-	-	-	-	-
Stage 1	944	-	-	-	-	-
Stage 2	622	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	6.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	796	1478	-
HCM Lane V/C Ratio	-	-	0.322	0.11	-
HCM Control Delay (s)	-	-	11.7	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.4	0.4	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	60	149	181	30	28	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	162	197	33	30	60

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	229	0	-	0	505	213
Stage 1	-	-	-	-	213	-
Stage 2	-	-	-	-	292	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1339	-	-	-	527	827
Stage 1	-	-	-	-	823	-
Stage 2	-	-	-	-	758	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1339	-	-	-	499	827
Mov Cap-2 Maneuver	-	-	-	-	499	-
Stage 1	-	-	-	-	823	-
Stage 2	-	-	-	-	718	-

Approach	EB	WB	SB
HCM Control Delay, s	2.2	0	11.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1339	-	-	-	677
HCM Lane V/C Ratio	0.049	-	-	-	0.133
HCM Control Delay (s)	7.8	0	-	-	11.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	30	147	183	493	455	28
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Adj Flow Rate, veh/h	33	160	199	536	495	30
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	53	912	691	587	591	528
Arrive On Green	0.03	0.49	0.37	0.37	0.33	0.33
Sat Flow, veh/h	1774	1863	1863	1583	1774	1583
Grp Volume(v), veh/h	33	160	199	536	495	30
Grp Sat Flow(s),veh/h/ln	1774	1863	1863	1583	1774	1583
Q Serve(g_s), s	0.8	2.2	3.4	14.5	11.7	0.6
Cycle Q Clear(g_c), s	0.8	2.2	3.4	14.5	11.7	0.6
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	53	912	691	587	591	528
V/C Ratio(X)	0.62	0.18	0.29	0.91	0.84	0.06
Avail Cap(c_a), veh/h	157	1031	701	596	1060	946
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.7	6.4	10.0	13.5	13.9	10.2
Incr Delay (d2), s/veh	11.2	0.1	0.2	18.4	3.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	1.1	1.8	9.2	6.2	0.6
LnGrp Delay(d),s/veh	32.8	6.5	10.2	31.9	17.2	10.3
LnGrp LOS	C	A	B	C	B	B
Approach Vol, veh/h		193	735		525	
Approach Delay, s/veh		11.0	26.0		16.8	
Approach LOS		B	C		B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.1		19.1	5.4	20.8
Change Period (Y+Rc), s				4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s				25.0		27.0	4.0	17.0
Max Q Clear Time (g_c+I1), s				4.2		13.7	2.8	16.5
Green Ext Time (p_c), s				3.8		1.4	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	20.7
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	16.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	1056	0	4	1126	65	2	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	1112	0	4	1185	68	2	0	12

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	1254	0	0	1112	0	0	1732	2393	556
Stage 1	-	-	-	-	-	-	1131	1131	-
Stage 2	-	-	-	-	-	-	601	1262	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	551	-	-	624	-	-	56	33	475
Stage 1	-	-	-	-	-	-	217	277	-
Stage 2	-	-	-	-	-	-	454	239	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	551	-	-	624	-	-	53	32	475
Mov Cap-2 Maneuver	-	-	-	-	-	-	53	32	-
Stage 1	-	-	-	-	-	-	213	272	-
Stage 2	-	-	-	-	-	-	431	237	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	23.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	213	551	-	-	624	-	-	59
HCM Lane V/C Ratio	0.064	0.017	-	-	0.007	-	-	1.57
HCM Control Delay (s)	23.1	11.6	-	-	10.8	-	-	$ 438.3
HCM Lane LOS	C	B	-	-	B	-	-	F
HCM 95th %tile Q(veh)	0.2	0.1	-	-	0	-	-	8.4

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	70	0	18
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	95	95	95
Heavy Vehicles, %	2	2	2
Mvmt Flow	74	0	19

Major/Minor	Minor2		
Conflicting Flow All	1803	2359	627
Stage 1	1228	1228	-
Stage 2	575	1131	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	~ 50	35	426
Stage 1	189	249	-
Stage 2	470	277	-
Platoon blocked, %			
Mov Cap-1 Maneuver	~ 48	34	426
Mov Cap-2 Maneuver	~ 48	34	-
Stage 1	186	247	-
Stage 2	451	272	-

Approach	SB
HCM Control Delay, s	$ 438.3
HCM LOS	F

Minor Lane/Major Mvmt

Intersection	
Intersection Delay, s/veh	11.9
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	220	5	71	0	0	1	0	0	65	32	2
Peak Hour Factor	0.92	0.83	0.83	0.83	0.92	0.83	0.83	0.83	0.92	0.83	0.83	0.83
Heavy Vehicles, %	2	6	6	6	2	6	6	6	2	6	6	6
Mvmt Flow	0	265	6	86	0	0	1	0	0	78	39	2
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	2	1
HCM Control Delay	13.3	8.8	10
HCM LOS	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	66%	74%	0%	25%	0%
Vol Thru, %	32%	2%	100%	75%	6%
Vol Right, %	2%	24%	0%	0%	94%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	99	296	1	20	246
LT Vol	32	5	1	15	15
Through Vol	2	71	0	0	231
RT Vol	65	220	0	5	0
Lane Flow Rate	119	357	1	24	296
Geometry Grp	5	2	2	7	7
Degree of Util (X)	0.188	0.503	0.002	0.039	0.413
Departure Headway (Hd)	5.679	5.079	5.753	5.807	5.017
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	636	703	625	611	708
Service Time	3.679	3.165	3.759	3.595	2.804
HCM Lane V/C Ratio	0.187	0.508	0.002	0.039	0.418
HCM Control Delay	10	13.3	8.8	8.8	11.3
HCM Lane LOS	A	B	A	A	B
HCM 95th-tile Q	0.7	2.8	0	0.1	2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	5	30	231
Peak Hour Factor	0.92	0.83	0.83	0.83
Heavy Vehicles, %	2	6	6	6
Mvmt Flow	0	6	36	278
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.1
HCM LOS	B

Lane

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	275	460	315	155	465	250
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	174.3	174.3	174.3	174.3	174.3	174.3
Lanes	1	1	2	1	2	1
Cap, veh/h	626	559	691	294	661	831
Arrive On Green	0.38	0.38	0.20	0.20	0.21	0.48
Sat Flow, veh/h	1660	1482	3486	1482	3221	1743
Grp Volume(v), veh/h	289	484	332	163	489	263
Grp Sat Flow(s),veh/h/ln	1660	1482	1743	1482	1610	1743
Q Serve(g_s), s	7.2	16.5	4.6	5.4	7.8	5.1
Cycle Q Clear(g_c), s	7.2	16.5	4.6	5.4	7.8	5.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	626	559	691	294	661	831
V/C Ratio(X)	0.46	0.87	0.48	0.56	0.74	0.32
Avail Cap(c_a), veh/h	850	759	1211	515	1237	1403
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	12.8	15.7	19.4	19.8	20.4	8.8
Incr Delay (d2), s/veh	0.5	7.9	2.4	7.4	1.7	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	2.7	6.6	2.1	2.5	3.1	2.1
Lane Grp Delay (d), s/veh	13.4	23.7	21.8	27.1	22.0	9.8
Lane Grp LOS	B	C	C	C	C	A
Approach Vol, veh/h	773		495			752
Approach Delay, s/veh	19.8		23.6			17.8
Approach LOS	B		C			B

Timer					
Assigned Phs			2		1	6
Phs Duration (G+Y+Rc), s			14.8		15.2	30.1
Change Period (Y+Rc), s			4.0		4.0	4.0
Max Green Setting (Gmax), s			19.0		21.0	44.0
Max Q Clear Time (g_c+I1), s			7.4		9.8	7.1
Green Ext Time (p_c), s			3.4		1.4	4.9

Intersection Summary	
HCM 2010 Ctrl Delay	20.0
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	410	140	215	520	165	175	230	405	275	220	40
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	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)	1770	1696	1442	1612	1696	1583	1612	1637	1370	1770	1863	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)	1770	1696	1442	1612	1696	1583	1612	1637	1370	1770	1863	1583
Peak-hour factor, PHF	0.92	0.93	0.93	0.93	0.93	0.92	0.93	0.92	0.93	0.92	0.92	0.92
Adj. Flow (vph)	76	441	151	231	559	179	188	250	435	299	239	43
RTOR Reduction (vph)	0	0	112	0	0	107	0	18	254	0	0	33
Lane Group Flow (vph)	76	441	39	231	559	72	188	345	68	299	239	10
Heavy Vehicles (%)	2%	12%	12%	12%	12%	2%	12%	2%	12%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	23.2	23.2	16.8	36.0	36.0	13.2	19.0	19.0	15.0	20.8	20.8
Effective Green, g (s)	4.0	23.2	23.2	16.8	36.0	36.0	13.2	19.0	19.0	15.0	20.8	20.8
Actuated g/C Ratio	0.04	0.26	0.26	0.19	0.40	0.40	0.15	0.21	0.21	0.17	0.23	0.23
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	78	437	371	300	678	633	236	345	289	295	430	365
v/s Ratio Prot	0.04	c0.26		0.14	c0.33		0.12	c0.21		c0.17	0.13	
v/s Ratio Perm			0.03			0.05			0.05			0.01
v/c Ratio	0.97	1.01	0.10	0.77	0.82	0.11	0.80	1.00	0.24	1.01	0.56	0.03
Uniform Delay, d1	42.9	33.4	25.5	34.8	24.2	17.0	37.1	35.5	29.5	37.5	30.5	26.8
Progression Factor	1.00	1.00	1.00	0.67	0.56	0.38	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	92.5	45.4	0.6	10.4	9.9	0.3	16.8	48.0	0.4	55.9	1.6	0.0
Delay (s)	135.5	78.8	26.0	33.6	23.4	6.8	53.9	83.5	29.9	93.4	32.1	26.8
Level of Service	F	E	C	C	C	A	D	F	C	F	C	C
Approach Delay (s)		73.3			22.8			57.3			63.2	
Approach LOS		E			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	51.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	895	100	275	720	30	120	0	215	80	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1671	4803	1495	1671	3343	1495	1671	1421	1421		1615	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1671	4803	1495	1671	3343	1495	1671	1421	1421		1615	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	103	973	109	299	783	33	130	0	234	87	0	60
RTOR Reduction (vph)	0	0	66	0	0	18	0	101	101	0	136	0
Lane Group Flow (vph)	103	973	43	299	783	15	130	16	16	0	11	0
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	12.8	35.3	35.3	19.6	42.1	42.1	12.2	12.2	12.2		6.9	
Effective Green, g (s)	12.8	35.3	35.3	19.6	42.1	42.1	12.2	12.2	12.2		6.9	
Actuated g/C Ratio	0.14	0.39	0.39	0.22	0.47	0.47	0.14	0.14	0.14		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	237	1883	586	363	1563	699	226	192	192		123	
v/s Ratio Prot	0.06	0.20		c0.18	c0.23		c0.08	0.01			c0.01	
v/s Ratio Perm			0.03			0.01			0.01			
v/c Ratio	0.43	0.52	0.07	0.82	0.50	0.02	0.58	0.08	0.08		0.09	
Uniform Delay, d1	35.3	20.8	17.1	33.6	16.6	12.9	36.5	34.0	34.0		38.6	
Progression Factor	1.10	0.52	0.64	0.73	1.14	1.00	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.6	0.5	0.1	13.6	1.1	0.1	3.5	0.2	0.2		0.3	
Delay (s)	39.4	11.2	11.0	38.2	20.1	12.9	40.0	34.2	34.2		39.0	
Level of Service	D	B	B	D	C	B	D	C	C		D	
Approach Delay (s)		13.7			24.8			36.3			39.0	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	1180	10	25	1015	55	0	0	10	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	7	7	7	7	7	7	7	7	7	7	7	7
Mvmt Flow	0	1229	10	26	1057	57	0	0	10	0	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1115	0	0	1229	0	0	1810	2396	615	1753	2367	557
Stage 1	-	-	-	-	-	-	1229	1229	-	1138	1138	-
Stage 2	-	-	-	-	-	-	581	1167	-	615	1229	-
Follow-up Headway	2.27	-	-	2.27	-	-	3.57	4.07	3.37	3.57	4.07	3.37
Pot Capacity-1 Maneuver	594	-	-	536	-	-	47	31	422	52	32	461
Stage 1	-	-	-	-	-	-	181	239	-	206	264	-
Stage 2	-	-	-	-	-	-	454	256	-	433	239	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	594	-	-	536	-	-	44	29	422	49	30	461
Mov Capacity-2 Maneuver	-	-	-	-	-	-	44	29	-	49	30	-
Stage 1	-	-	-	-	-	-	181	239	-	206	251	-
Stage 2	-	-	-	-	-	-	422	244	-	422	239	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	13.7	13
HCM LOS			B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	422	594	-	-	536	-	-	461
HCM Lane V/C Ratio	0.025	-	-	-	0.049	-	-	0.023
HCM Control Delay (s)	13.7	0	-	-	12.059	-	-	13
HCM Lane LOS	B	A			B			B
HCM 95th %tile Q(veh)	0.076	0	-	-	0.153	-	-	0.069

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	815	375	200	700	0	0	0	0	85	5	395
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	172.7	172.7	172.7	172.7	0.0				172.7	172.7	172.7
Lanes	0	3	2	1	3	0				2	1	2
Cap, veh/h	0	2553	1447	250	3570	0				709	384	653
Arrive On Green	0.00	0.99	0.99	0.30	1.00	0.00				0.22	0.22	0.22
Sat Flow, veh/h	0	5182	2936	1645	5182	0				3191	1727	2936
Grp Volume(v), veh/h	0	886	408	217	761	0				92	5	429
Grp Sat Flow(s),veh/h/ln	0	1727	1468	1645	1727	0				1596	1727	1468
Q Serve(g_s), s	0.0	0.3	0.3	11.2	0.0	0.0				2.1	0.2	12.0
Cycle Q Clear(g_c), s	0.0	0.3	0.3	11.2	0.0	0.0				2.1	0.2	12.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2553	1447	250	3570	0				709	384	653
V/C Ratio(X)	0.00	0.35	0.28	0.87	0.21	0.00				0.13	0.01	0.66
Avail Cap(c_a), veh/h	0	2553	1447	475	3570	0				709	384	653
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.92	0.92	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.3	0.3	30.5	0.0	0.0				28.0	27.3	31.9
Incr Delay (d2), s/veh	0.0	0.4	0.5	8.3	0.1	0.0				0.4	0.1	5.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	0.2	0.2	4.5	0.0	0.0				0.9	0.1	4.8
Lane Grp Delay (d), s/veh	0.0	0.7	0.8	38.8	0.1	0.0				28.4	27.4	37.0
Lane Grp LOS		A	A	D	A					C	C	D
Approach Vol, veh/h		1294			978						526	
Approach Delay, s/veh		0.7			8.7						35.4	
Approach LOS		A			A						D	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		48.3		17.7	66.0						24.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		32.0		26.0	62.0						20.0	
Max Q Clear Time (g_c+I1), s		2.3		13.2	2.0						14.0	
Green Ext Time (p_c), s		17.3		0.5	23.9						1.2	

Intersection Summary	
HCM 2010 Ctrl Delay	10.0
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	480	420	0	0	590	20	310	100	200	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	172.7	172.7	0.0	0.0	172.7	172.7	172.7	172.7	172.7			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1186	3282	0	0	1727	489	886	480	408			
Arrive On Green	0.43	1.00	0.00	0.00	0.33	0.33	0.28	0.28	0.28			
Sat Flow, veh/h	4639	5182	0	0	5182	1468	3191	1727	1468			
Grp Volume(v), veh/h	522	457	0	0	641	22	337	109	217			
Grp Sat Flow(s),veh/h/ln	1546	1727	0	0	1727	1468	1596	1727	1468			
Q Serve(g_s), s	7.1	0.0	0.0	0.0	8.5	0.9	7.7	4.4	11.3			
Cycle Q Clear(g_c), s	7.1	0.0	0.0	0.0	8.5	0.9	7.7	4.4	11.3			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1186	3282	0	0	1727	489	886	480	408			
V/C Ratio(X)	0.44	0.14	0.00	0.00	0.37	0.04	0.38	0.23	0.53			
Avail Cap(c_a), veh/h	1186	3282	0	0	1727	489	886	480	408			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.93	0.93	0.00	0.00	0.88	0.88	1.00	1.00	1.00			
Uniform Delay (d), s/veh	21.3	0.0	0.0	0.0	22.8	20.3	26.2	25.1	27.5			
Incr Delay (d2), s/veh	0.2	0.1	0.0	0.0	0.5	0.2	1.2	1.1	4.9			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	2.4	0.0	0.0	0.0	3.6	0.3	3.1	2.0	4.7			
Lane Grp Delay (d), s/veh	21.5	0.1	0.0	0.0	23.4	20.5	27.5	26.2	32.4			
Lane Grp LOS	C	A			C	C	C	C	C			
Approach Vol, veh/h		979			663			663				
Approach Delay, s/veh		11.5			23.3			28.9				
Approach LOS		B			C			C				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	27.0	61.0			34.0			29.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	23.0	57.0			30.0			25.0				
Max Q Clear Time (g_c+I1), s	9.1	2.0			10.5			13.3				
Green Ext Time (p_c), s	4.5	6.1			4.5			2.2				

Intersection Summary												
HCM 2010 Ctrl Delay			19.9									
HCM 2010 LOS			B									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	460	0	160	0	0	0	85	20	0	0	70	525
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	174.3	174.3	190.0	174.3	190.0	174.3	174.3	190.0	174.3	174.3	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	628	0	560	0	659	0	115	1636	0	3	565	480
Arrive On Green	0.38	0.00	0.38	0.00	0.00	0.00	0.07	0.47	0.00	0.00	0.32	0.32
Sat Flow, veh/h	1660	0	1482	0	1743	0	1660	3486	0	1660	1743	1482
Grp Volume(v), veh/h	500	0	174	0	0	0	92	22	0	0	76	571
Grp Sat Flow(s),veh/h/ln	1660	0	1482	0	1743	0	1660	1743	0	1660	1743	1482
Q Serve(g_s), s	14.1	0.0	4.3	0.0	0.0	0.0	2.9	0.2	0.0	0.0	1.6	17.0
Cycle Q Clear(g_c), s	14.1	0.0	4.3	0.0	0.0	0.0	2.9	0.2	0.0	0.0	1.6	17.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	628	0	560	0	659	0	115	1636	0	3	565	480
V/C Ratio(X)	0.80	0.00	0.31	0.00	0.00	0.00	0.80	0.01	0.00	0.00	0.13	1.19
Avail Cap(c_a), veh/h	1076	0	960	0	659	0	222	1636	0	127	565	480
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.00	0.98	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	14.5	0.0	11.5	0.0	0.0	0.0	24.1	7.4	0.0	0.0	12.5	17.7
Incr Delay (d2), s/veh	2.3	0.0	0.3	0.0	0.0	0.0	12.2	0.0	0.0	0.0	0.5	104.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	5.5	0.0	1.4	0.0	0.0	0.0	1.5	0.1	0.0	0.0	0.7	19.5
Lane Grp Delay (d), s/veh	16.8	0.0	11.8	0.0	0.0	0.0	36.3	7.5	0.0	0.0	13.0	122.1
Lane Grp LOS	B		B				D	A			B	F
Approach Vol, veh/h		674			0			114			647	
Approach Delay, s/veh		15.5			0.0			30.7			109.3	
Approach LOS		B						C			F	

Timer								
Assigned Phs		4			8		5	2		1	6	
Phs Duration (G+Y+Rc), s		23.8			23.8		7.6	28.6		0.0	21.0	
Change Period (Y+Rc), s		4.0			4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s		34.0			16.0		7.0	20.0		4.0	17.0	
Max Q Clear Time (g_c+I1), s		16.1			0.0		4.9	2.2		0.0	19.0	
Green Ext Time (p_c), s		3.8			0.0		0.0	4.7		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	59.0
HCM 2010 LOS	E

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	510	880	305	250	760	310
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	2	1	2	1
Cap, veh/h	693	618	735	312	899	948
Arrive On Green	0.39	0.39	0.20	0.20	0.26	0.51
Sat Flow, veh/h	1774	1583	3725	1583	3442	1863
Grp Volume(v), veh/h	554	957	332	272	826	337
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	22.0	31.0	6.2	13.2	18.5	8.6
Cycle Q Clear(g_c), s	22.0	31.0	6.2	13.2	18.5	8.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	693	618	735	312	899	948
V/C Ratio(X)	0.80	1.55	0.45	0.87	0.92	0.36
Avail Cap(c_a), veh/h	693	618	751	319	910	962
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.4	24.2	28.1	30.9	28.5	11.7
Incr Delay (d2), s/veh	6.6	254.4	0.4	21.8	14.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	10.7	55.3	2.9	7.0	9.6	3.7
Lane Grp Delay (d), s/veh	28.1	278.6	28.5	52.6	42.6	11.9
Lane Grp LOS	C	F	C	D	D	B
Approach Vol, veh/h	1511		604			1163
Approach Delay, s/veh	186.8		39.4			33.7
Approach LOS	F		D			C

Timer					
Assigned Phs			2	1	6
Phs Duration (G+Y+Rc), s			19.7	24.7	44.4
Change Period (Y+Rc), s			4.0	4.0	4.0
Max Green Setting (Gmax), s			16.0	21.0	41.0
Max Q Clear Time (g_c+I1), s			15.2	20.5	10.6
Green Ext Time (p_c), s			0.4	0.2	5.8

Intersection Summary	
HCM 2010 Ctrl Delay	105.3
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	565	285	525	965	475	280	450	600	655	570	145
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	614	310	571	1049	516	304	489	652	712	620	158
RTOR Reduction (vph)	0	0	106	0	0	162	0	7	327	0	0	80
Lane Group Flow (vph)	174	614	204	571	1049	354	304	599	208	712	620	78
Heavy Vehicles (%)	2%	3%	3%	3%	3%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.0	28.0	28.0	26.0	47.0	47.0	11.0	26.0	26.0	24.0	39.0	39.0
Effective Green, g (s)	7.0	28.0	28.0	26.0	47.0	47.0	11.0	26.0	26.0	24.0	39.0	39.0
Actuated g/C Ratio	0.06	0.23	0.23	0.22	0.39	0.39	0.09	0.22	0.22	0.20	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	103	430	365	379	722	620	160	371	322	354	605	514
v/s Ratio Prot	0.10	c0.33		0.33	c0.57		0.17	c0.35		c0.40	0.33	
v/s Ratio Perm			0.13			0.22			0.14			0.05
v/c Ratio	1.69	1.43	0.56	1.51	1.45	0.57	1.90	1.61	0.64	2.01	1.02	0.15
Uniform Delay, d1	56.5	46.0	40.6	47.0	36.5	28.6	54.5	47.0	42.8	48.0	40.5	28.8
Progression Factor	1.00	1.00	1.00	0.94	0.59	0.32	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	348.3	205.6	6.1	235.5	208.1	2.1	427.5	288.7	4.4	465.0	43.0	0.1
Delay (s)	404.8	251.6	46.6	279.7	229.6	11.3	482.0	335.7	47.2	513.0	83.5	28.9
Level of Service	F	F	D	F	F	B	F	F	D	F	F	C
Approach Delay (s)		218.0			190.3			259.7			283.0	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	233.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	145.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	1630	125	435	1730	65	185	0	320	110	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1725	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1725	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	68	1698	130	453	1802	68	193	0	333	115	0	52
RTOR Reduction (vph)	0	0	71	0	0	28	0	146	145	0	109	0
Lane Group Flow (vph)	68	1698	59	453	1802	40	193	21	21	0	58	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	8.3	48.0	48.0	31.0	70.7	70.7	15.4	15.4	15.4		9.6	
Effective Green, g (s)	8.3	48.0	48.0	31.0	70.7	70.7	15.4	15.4	15.4		9.6	
Actuated g/C Ratio	0.07	0.40	0.40	0.26	0.59	0.59	0.13	0.13	0.13		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	122	2034	633	457	2085	932	227	193	193		138	
v/s Ratio Prot	0.04	0.33		c0.26	c0.51		c0.11	0.01			c0.03	
v/s Ratio Perm			0.04			0.03			0.01			
v/c Ratio	0.56	0.83	0.09	0.99	0.86	0.04	0.85	0.11	0.11		0.42	
Uniform Delay, d1	54.1	32.4	22.4	44.4	20.6	10.4	51.2	46.2	46.2		52.6	
Progression Factor	1.19	0.58	0.79	0.62	0.37	0.22	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.5	0.4	0.0	34.4	3.9	0.1	25.0	0.3	0.3		2.1	
Delay (s)	64.9	19.3	17.7	62.0	11.5	2.4	76.1	46.5	46.5		54.7	
Level of Service	E	B	B	E	B	A	E	D	D		D	
Approach Delay (s)		20.9			21.1			57.4			54.7	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	2045	15	35	2210	85	0	0	15	0	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2176	16	37	2351	90	0	0	16	0	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	2441	0	0	2176	0	0	3426	4692	1088	3559	4647	1221
Stage 1	-	-	-	-	-	-	2176	2176	-	2471	2471	-
Stage 2	-	-	-	-	-	-	1250	2516	-	1088	2176	-
Follow-up Headway	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Capacity-1 Maneuver	189	-	-	241	-	-	3	1	211	2	1	172
Stage 1	-	-	-	-	-	-	47	84	-	30	59	-
Stage 2	-	-	-	-	-	-	183	56	-	230	84	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	189	-	-	241	-	-	2	1	211	2	1	172
Mov Capacity-2 Maneuver	-	-	-	-	-	-	2	1	-	2	1	-
Stage 1	-	-	-	-	-	-	47	84	-	30	50	-
Stage 2	-	-	-	-	-	-	136	47	-	213	84	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	23.5	28.9
HCM LOS			C	D

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	211	189	-	-	241	-	-	172
HCM Lane V/C Ratio	0.076	-	-	-	0.154	-	-	0.124
HCM Control Delay (s)	23.5	0	-	-	22.648	-	-	28.9
HCM Lane LOS	C	A			C			D
HCM 95th %tile Q(veh)	0.243	0	-	-	0.537	-	-	0.414

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1480	580	295	1515	0	0	0	0	55	5	815
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	182.7	182.7	182.7	182.7	0.0				182.7	182.7	182.7
Lanes	0	3	2	1	3	0				2	1	2
Cap, veh/h	0	2010	1139	377	3380	0				1069	579	983
Arrive On Green	0.00	0.73	0.73	0.43	1.00	0.00				0.32	0.32	0.32
Sat Flow, veh/h	0	5481	3106	1740	5481	0				3375	1827	3106
Grp Volume(v), veh/h	0	1542	604	307	1578	0				57	5	849
Grp Sat Flow(s),veh/h/ln	0	1827	1553	1740	1827	0				1688	1827	1553
Q Serve(g_s), s	0.0	20.6	10.2	18.5	0.0	0.0				1.4	0.2	30.8
Cycle Q Clear(g_c), s	0.0	20.6	10.2	18.5	0.0	0.0				1.4	0.2	30.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2010	1139	377	3380	0				1069	579	983
V/C Ratio(X)	0.00	0.77	0.53	0.81	0.47	0.00				0.05	0.01	0.86
Avail Cap(c_a), veh/h	0	2010	1139	377	3380	0				1069	579	983
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.61	0.61	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	12.9	11.5	31.9	0.0	0.0				28.5	28.1	38.6
Incr Delay (d2), s/veh	0.0	2.9	1.8	8.3	0.3	0.0				0.1	0.0	9.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	6.2	2.9	7.9	0.1	0.0				0.6	0.1	13.5
Lane Grp Delay (d), s/veh	0.0	15.8	13.3	40.1	0.3	0.0				28.6	28.1	48.5
Lane Grp LOS		B	B	D	A					C	C	D
Approach Vol, veh/h		2146			1885						911	
Approach Delay, s/veh		15.1			6.8						47.1	
Approach LOS		B			A						D	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		48.0		30.0	78.0						42.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		44.0		26.0	74.0						38.0	
Max Q Clear Time (g_c+I1), s		22.6		20.5	2.0						32.8	
Green Ext Time (p_c), s		14.7		4.5	22.9						2.0	

Intersection Summary												
HCM 2010 Ctrl Delay			17.8									
HCM 2010 LOS			B									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	835	700	0	0	1095	80	715	135	210	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	181.0	181.0	0.0	0.0	181.0	181.0	181.0	181.0	181.0			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1215	3348	0	0	1810	513	1059	573	487			
Arrive On Green	0.42	1.00	0.00	0.00	0.33	0.33	0.32	0.32	0.32			
Sat Flow, veh/h	4860	5429	0	0	5429	1538	3343	1810	1538			
Grp Volume(v), veh/h	908	761	0	0	1190	87	777	147	228			
Grp Sat Flow(s),veh/h/ln	1620	1810	0	0	1810	1538	1672	1810	1538			
Q Serve(g_s), s	19.0	0.0	0.0	0.0	22.5	4.8	24.8	7.3	14.3			
Cycle Q Clear(g_c), s	19.0	0.0	0.0	0.0	22.5	4.8	24.8	7.3	14.3			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1215	3348	0	0	1810	513	1059	573	487			
V/C Ratio(X)	0.75	0.23	0.00	0.00	0.66	0.17	0.73	0.26	0.47			
Avail Cap(c_a), veh/h	1215	3348	0	0	1810	513	1059	573	487			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.47	0.47	0.00	0.00	0.20	0.20	1.00	1.00	1.00			
Uniform Delay (d), s/veh	31.7	0.0	0.0	0.0	34.2	28.3	36.5	30.5	32.9			
Incr Delay (d2), s/veh	1.2	0.1	0.0	0.0	0.4	0.1	4.5	1.1	3.2			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	7.1	0.0	0.0	0.0	10.3	1.9	11.1	3.5	6.0			
Lane Grp Delay (d), s/veh	33.0	0.1	0.0	0.0	34.5	28.4	41.0	31.6	36.1			
Lane Grp LOS	C	A			C	C	D	C	D			
Approach Vol, veh/h		1669			1277			1152				
Approach Delay, s/veh		18.0			34.1			38.8				
Approach LOS		B			C			D				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	34.0	78.0			44.0			42.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	30.0	74.0			40.0			38.0				
Max Q Clear Time (g_c+I1), s	21.0	2.0			24.5			26.8				
Green Ext Time (p_c), s	5.7	13.1			7.9			3.8				

Intersection Summary												
HCM 2010 Ctrl Delay			28.9									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	685	0	225	0	0	0	220	125	0	0	90	955
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	182.7	182.7	190.0	182.7	190.0	182.7	182.7	190.0	182.7	182.7	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	843	0	752	0	885	0	277	252	0	529	391	332
Arrive On Green	0.48	0.00	0.48	0.00	0.00	0.00	0.16	0.07	0.00	0.00	0.21	0.21
Sat Flow, veh/h	1740	0	1553	0	1827	0	1740	3654	0	1740	1827	1553
Grp Volume(v), veh/h	745	0	245	0	0	0	239	136	0	0	98	1038
Grp Sat Flow(s),veh/h/ln	1740	0	1553	0	1827	0	1740	1827	0	1740	1827	1553
Q Serve(g_s), s	32.5	0.0	8.1	0.0	0.0	0.0	11.3	3.0	0.0	0.0	3.8	18.0
Cycle Q Clear(g_c), s	32.5	0.0	8.1	0.0	0.0	0.0	11.3	3.0	0.0	0.0	3.8	18.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	843	0	752	0	885	0	277	252	0	529	391	332
V/C Ratio(X)	0.88	0.00	0.33	0.00	0.00	0.00	0.86	0.54	0.00	0.00	0.25	3.13
Avail Cap(c_a), veh/h	1095	0	977	0	885	0	331	1302	0	529	391	332
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.97	0.00	0.97	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	19.6	0.0	13.3	0.0	0.0	0.0	34.5	37.9	0.0	0.0	27.5	33.1
Incr Delay (d2), s/veh	6.9	0.0	0.2	0.0	0.0	0.0	17.9	1.8	0.0	0.0	0.3	965.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	14.9	0.0	2.9	0.0	0.0	0.0	6.3	1.5	0.0	0.0	1.8	96.0
Lane Grp Delay (d), s/veh	26.5	0.0	13.5	0.0	0.0	0.0	52.4	39.7	0.0	0.0	27.8	998.2
Lane Grp LOS	C		B				D	D			C	F
Approach Vol, veh/h		990			0			375			1136	
Approach Delay, s/veh		23.3			0.0			47.8			914.5	
Approach LOS		C						D			F	

Timer								
Assigned Phs		4			8		5	2		1	6	
Phs Duration (G+Y+Rc), s		44.8			44.8		17.4	9.8		29.6	22.0	
Change Period (Y+Rc), s		4.0			4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s		53.0			17.0		16.0	30.0		4.0	18.0	
Max Q Clear Time (g_c+I1), s		34.5			0.0		13.3	5.0		0.0	20.0	
Green Ext Time (p_c), s		6.3			0.0		0.2	0.8		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	431.8
HCM 2010 LOS	F

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	395	695	310	265	700	365
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	2	1	2	1
Cap, veh/h	674	601	770	327	882	960
Arrive On Green	0.38	0.38	0.21	0.21	0.26	0.52
Sat Flow, veh/h	1774	1583	3725	1583	3442	1863
Grp Volume(v), veh/h	429	755	337	288	761	397
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	15.1	29.0	6.0	13.5	16.1	10.0
Cycle Q Clear(g_c), s	15.1	29.0	6.0	13.5	16.1	10.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	674	601	770	327	882	960
V/C Ratio(X)	0.64	1.26	0.44	0.88	0.86	0.41
Avail Cap(c_a), veh/h	674	601	781	332	1037	1049
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	23.7	26.4	29.4	27.1	11.4
Incr Delay (d2), s/veh	2.0	128.3	0.4	22.5	6.7	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	6.8	32.2	2.8	7.3	7.6	4.3
Lane Grp Delay (d), s/veh	21.4	151.9	26.8	51.9	33.8	11.7
Lane Grp LOS	C	F	C	D	C	B
Approach Vol, veh/h	1184		625			1158
Approach Delay, s/veh	104.6		38.4			26.2
Approach LOS	F		D			C

Timer					
Assigned Phs			2	1	6
Phs Duration (G+Y+Rc), s			19.8	23.6	43.4
Change Period (Y+Rc), s			4.0	4.0	4.0
Max Green Setting (Gmax), s			16.0	23.0	43.0
Max Q Clear Time (g_c+I1), s			15.5	18.1	12.0
Green Ext Time (p_c), s			0.3	1.5	6.5

Intersection Summary	
HCM 2010 Ctrl Delay	60.1
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	470	355	620	645	485	345	480	645	600	590	100
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	511	386	674	701	527	375	522	701	652	641	109
RTOR Reduction (vph)	0	0	158	0	0	248	0	7	363	0	0	76
Lane Group Flow (vph)	152	511	228	674	701	279	375	641	212	652	641	33
Heavy Vehicles (%)	2%	3%	3%	3%	3%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	25.0	25.0	29.0	45.0	45.0	14.0	28.0	28.0	22.0	36.0	36.0
Effective Green, g (s)	9.0	25.0	25.0	29.0	45.0	45.0	14.0	28.0	28.0	22.0	36.0	36.0
Actuated g/C Ratio	0.08	0.21	0.21	0.24	0.38	0.38	0.12	0.23	0.23	0.18	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	132	384	326	423	691	593	204	400	347	324	558	474
v/s Ratio Prot	0.09	c0.28		c0.38	0.38		0.21	c0.37		c0.37	0.34	
v/s Ratio Perm			0.15			0.18			0.14			0.02
v/c Ratio	1.15	1.33	0.70	1.59	1.01	0.47	1.84	1.60	0.61	2.01	1.15	0.07
Uniform Delay, d1	55.5	47.5	44.0	45.5	37.5	28.5	53.0	46.0	41.1	49.0	42.0	30.0
Progression Factor	1.00	1.00	1.00	0.93	0.70	0.50	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	124.8	165.8	11.8	273.9	30.6	1.7	395.7	282.7	3.0	466.3	86.3	0.1
Delay (s)	180.3	213.3	55.8	316.1	56.8	16.0	448.7	328.7	44.1	515.3	128.3	30.1
Level of Service	F	F	E	F	E	B	F	F	D	F	F	C
Approach Delay (s)		150.5			137.4			254.5			300.6	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	209.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	144.0%	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)	80	1445	190	600	1395	70	280	0	475	110	0	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1710	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1710	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	83	1505	198	625	1453	73	292	0	495	115	0	78
RTOR Reduction (vph)	0	0	112	0	0	32	0	213	212	0	107	0
Lane Group Flow (vph)	83	1505	86	625	1453	41	292	35	35	0	86	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.3	38.1	38.1	38.0	66.8	66.8	17.0	17.0	17.0		10.9	
Effective Green, g (s)	9.3	38.1	38.1	38.0	66.8	66.8	17.0	17.0	17.0		10.9	
Actuated g/C Ratio	0.08	0.32	0.32	0.32	0.56	0.56	0.14	0.14	0.14		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	137	1614	502	560	1970	881	250	213	213		155	
v/s Ratio Prot	0.05	c0.30		c0.35	0.41		c0.17	0.02			c0.05	
v/s Ratio Perm			0.05			0.03			0.02			
v/c Ratio	0.61	0.93	0.17	1.12	0.74	0.05	1.17	0.16	0.16		0.55	
Uniform Delay, d1	53.6	39.7	29.6	41.0	20.0	12.1	51.5	45.3	45.3		52.2	
Progression Factor	1.10	0.61	0.72	1.01	0.98	0.95	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.7	1.3	0.1	68.1	1.7	0.1	110.0	0.4	0.4		4.2	
Delay (s)	59.7	25.4	21.5	109.3	21.4	11.6	161.5	45.6	45.6		56.4	
Level of Service	E	C	C	F	C	B	F	D	D		E	
Approach Delay (s)		26.6			46.6			88.6			56.4	
Approach LOS		C			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	46.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	2010	20	55	2045	90	0	0	20	0	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2138	21	59	2176	96	0	0	21	0	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	2271	0	0	2138	0	0	3343	4526	1069	3409	4478	1136
Stage 1	-	-	-	-	-	-	2138	2138	-	2340	2340	-
Stage 2	-	-	-	-	-	-	1205	2388	-	1069	2138	-
Follow-up Headway	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Capacity-1 Maneuver	221	-	-	250	-	-	3	1	217	3	1	196
Stage 1	-	-	-	-	-	-	50	88	-	37	69	-
Stage 2	-	-	-	-	-	-	195	65	-	236	88	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	221	-	-	250	-	-	2	1	217	2	1	196
Mov Capacity-2 Maneuver	-	-	-	-	-	-	2	1	-	2	1	-
Stage 1	-	-	-	-	-	-	50	88	-	37	53	-
Stage 2	-	-	-	-	-	-	133	50	-	213	88	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.6	23.4	25.6
HCM LOS			C	D

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	217	221	-	-	250	-	-	196
HCM Lane V/C Ratio	0.098	-	-	-	0.234	-	-	0.109
HCM Control Delay (s)	23.4	0	-	-	23.745	-	-	25.6
HCM Lane LOS	C	A			C			D
HCM 95th %tile Q(veh)	0.322	0	-	-	0.884	-	-	0.359

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1405	625	220	1475	0	0	0	0	110	5	715
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	182.7	182.7	182.7	182.7	0.0				182.7	182.7	182.7
Lanes	0	3	2	1	2	0				2	1	2
Cap, veh/h	0	2351	1332	254	2223	0				1097	594	1009
Arrive On Green	0.00	0.86	0.86	0.29	1.00	0.00				0.32	0.32	0.32
Sat Flow, veh/h	0	5481	3106	1740	3654	0				3375	1827	3106
Grp Volume(v), veh/h	0	1464	651	229	1536	0				115	5	745
Grp Sat Flow(s),veh/h/ln	0	1827	1553	1740	1827	0				1688	1827	1553
Q Serve(g_s), s	0.0	9.8	6.2	15.2	0.0	0.0				2.9	0.2	25.6
Cycle Q Clear(g_c), s	0.0	9.8	6.2	15.2	0.0	0.0				2.9	0.2	25.6
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2351	1332	254	2223	0				1097	594	1009
V/C Ratio(X)	0.00	0.62	0.49	0.90	0.69	0.00				0.10	0.01	0.74
Avail Cap(c_a), veh/h	0	2351	1332	348	2223	0				1097	594	1009
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.68	0.68	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	5.6	5.3	41.6	0.0	0.0				28.3	27.4	36.0
Incr Delay (d2), s/veh	0.0	1.3	1.3	15.1	1.2	0.0				0.2	0.0	4.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	2.5	1.7	7.1	0.4	0.0				1.2	0.1	10.7
Lane Grp Delay (d), s/veh	0.0	6.8	6.6	56.8	1.2	0.0				28.5	27.4	40.8
Lane Grp LOS		A	A	E	A					C	C	D
Approach Vol, veh/h		2115			1765						865	
Approach Delay, s/veh		6.7			8.4						39.1	
Approach LOS		A			A						D	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		55.5		21.5	77.0						43.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		45.0		24.0	73.0						39.0	
Max Q Clear Time (g_c+I1), s		11.8		17.2	2.0						27.6	
Green Ext Time (p_c), s		30.5		0.4	59.8						3.0	

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	815	700	0	0	1095	50	600	95	150	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	181.0	181.0	0.0	0.0	181.0	181.0	181.0	181.0	181.0			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1255	3529	0	0	1945	551	947	513	436			
Arrive On Green	0.43	1.00	0.00	0.00	0.12	0.12	0.28	0.28	0.28			
Sat Flow, veh/h	4860	5429	0	0	5429	1538	3343	1810	1538			
Grp Volume(v), veh/h	886	761	0	0	1190	54	652	103	163			
Grp Sat Flow(s),veh/h/ln	1620	1810	0	0	1810	1538	1672	1810	1538			
Q Serve(g_s), s	17.9	0.0	0.0	0.0	25.0	3.8	20.8	5.2	10.2			
Cycle Q Clear(g_c), s	17.9	0.0	0.0	0.0	25.0	3.8	20.8	5.2	10.2			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1255	3529	0	0	1945	551	947	513	436			
V/C Ratio(X)	0.71	0.22	0.00	0.00	0.61	0.10	0.69	0.20	0.37			
Avail Cap(c_a), veh/h	1255	3529	0	0	1945	551	947	513	436			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	0.33	0.33	1.00	1.00	1.00			
Upstream Filter(I)	0.68	0.68	0.00	0.00	0.29	0.29	1.00	1.00	1.00			
Uniform Delay (d), s/veh	30.4	0.0	0.0	0.0	45.0	35.6	38.3	32.7	34.5			
Incr Delay (d2), s/veh	1.2	0.1	0.0	0.0	0.4	0.1	4.1	0.9	2.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	6.7	0.0	0.0	0.0	12.4	1.5	9.4	2.5	4.3			
Lane Grp Delay (d), s/veh	31.6	0.1	0.0	0.0	45.4	35.7	42.4	33.6	36.9			
Lane Grp LOS	C	A			D	D	D	C	D			
Approach Vol, veh/h		1647			1244			918				
Approach Delay, s/veh		17.1			45.0			40.4				
Approach LOS		B			D			D				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	35.0	82.0			47.0			38.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	31.0	78.0			43.0			34.0				
Max Q Clear Time (g_c+I1), s	19.9	2.0			27.0			22.8				
Green Ext Time (p_c), s	6.5	12.9			7.9			3.0				

Intersection Summary												
HCM 2010 Ctrl Delay			31.8									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	650	0	200	0	0	0	205	125	0	0	90	940
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	182.7	182.7	190.0	182.7	190.0	182.7	182.7	190.0	182.7	182.7	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	812	0	725	0	853	0	264	260	0	538	418	355
Arrive On Green	0.47	0.00	0.47	0.00	0.00	0.00	0.15	0.07	0.00	0.00	0.23	0.23
Sat Flow, veh/h	1740	0	1553	0	1827	0	1740	3654	0	1740	1827	1553
Grp Volume(v), veh/h	707	0	217	0	0	0	223	136	0	0	98	1022
Grp Sat Flow(s),veh/h/ln	1740	0	1553	0	1827	0	1740	1827	0	1740	1827	1553
Q Serve(g_s), s	28.7	0.0	6.8	0.0	0.0	0.0	9.8	2.8	0.0	0.0	3.4	18.0
Cycle Q Clear(g_c), s	28.7	0.0	6.8	0.0	0.0	0.0	9.8	2.8	0.0	0.0	3.4	18.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	812	0	725	0	853	0	264	260	0	538	418	355
V/C Ratio(X)	0.87	0.00	0.30	0.00	0.00	0.00	0.84	0.52	0.00	0.00	0.23	2.88
Avail Cap(c_a), veh/h	1127	0	1006	0	853	0	354	1393	0	538	418	355
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.00	0.98	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	18.8	0.0	13.0	0.0	0.0	0.0	32.5	35.3	0.0	0.0	24.7	30.4
Incr Delay (d2), s/veh	5.5	0.0	0.2	0.0	0.0	0.0	13.0	1.6	0.0	0.0	0.3	852.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	12.6	0.0	2.4	0.0	0.0	0.0	5.2	1.4	0.0	0.0	1.6	91.0
Lane Grp Delay (d), s/veh	24.4	0.0	13.2	0.0	0.0	0.0	45.5	36.9	0.0	0.0	25.0	883.1
Lane Grp LOS	C		B				D	D			C	F
Approach Vol, veh/h		924			0			359			1120	
Approach Delay, s/veh		21.7			0.0			42.2			808.0	
Approach LOS		C						D			F	

Timer								
Assigned Phs		4			8		5	2		1	6	
Phs Duration (G+Y+Rc), s		40.7			40.7		16.0	9.6		28.4	22.0	
Change Period (Y+Rc), s		4.0			4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s		51.0			19.0		16.0	30.0		4.0	18.0	
Max Q Clear Time (g_c+I1), s		30.7			0.0		11.8	4.8		0.0	20.0	
Green Ext Time (p_c), s		6.0			0.0		0.2	0.8		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	391.3
HCM 2010 LOS	F

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	279	468	315	161	477	250
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	174.3	174.3	174.3	174.3	174.3	174.3
Lanes	1	1	2	1	2	1
Cap, veh/h	632	564	692	294	669	832
Arrive On Green	0.38	0.38	0.20	0.20	0.21	0.48
Sat Flow, veh/h	1660	1482	3486	1482	3221	1743
Grp Volume(v), veh/h	294	493	332	169	502	263
Grp Sat Flow(s),veh/h/ln	1660	1482	1743	1482	1610	1743
Q Serve(g_s), s	7.5	17.4	4.8	5.8	8.2	5.2
Cycle Q Clear(g_c), s	7.5	17.4	4.8	5.8	8.2	5.2
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	632	564	692	294	669	832
V/C Ratio(X)	0.47	0.87	0.48	0.57	0.75	0.32
Avail Cap(c_a), veh/h	825	737	1176	500	1201	1362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.1	16.2	20.0	20.4	20.9	9.1
Incr Delay (d2), s/veh	0.5	9.2	2.4	7.9	1.7	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	2.9	7.0	2.2	2.7	3.3	2.2
Lane Grp Delay (d), s/veh	13.7	25.4	22.4	28.3	22.7	10.1
Lane Grp LOS	B	C	C	C	C	B
Approach Vol, veh/h	787		501			765
Approach Delay, s/veh	21.0		24.4			18.3
Approach LOS	C		C			B

Timer						
Assigned Phs			2		1	6
Phs Duration (G+Y+Rc), s			15.2		15.7	30.9
Change Period (Y+Rc), s			4.0		4.0	4.0
Max Green Setting (Gmax), s			19.0		21.0	44.0
Max Q Clear Time (g_c+I1), s			7.8		10.2	7.2
Green Ext Time (p_c), s			3.4		1.5	4.9

Intersection Summary	
HCM 2010 Ctrl Delay	20.8
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	6	632	743	12	8	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	687	808	13	9	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	821	0	-	0	1514	814
Stage 1	-	-	-	-	814	-
Stage 2	-	-	-	-	700	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	808	-	-	-	132	378
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	493	-
Time blocked-Platoon, %		-	-	-		
Mov Capacity-1 Maneuver	808	-	-	-	130	378
Mov Capacity-2 Maneuver	-	-	-	-	130	-
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	486	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	28.5
HCM LOS			D

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	808	-	-	-	166
HCM Lane V/C Ratio	0.008	-	-	-	0.079
HCM Control Delay (s)	9.492	0	-	-	28.5
HCM Lane LOS	A	A			D
HCM 95th %tile Q(veh)	0.024	-	-	-	0.252

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	12	628	747	140	86	8
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	1	1	1	1
Cap, veh/h	24	1289	1074	913	186	166
Arrive On Green	0.01	0.69	0.58	0.58	0.10	0.10
Sat Flow, veh/h	1774	1863	1863	1583	1774	1583
Grp Volume(v), veh/h	13	683	812	152	93	9
Grp Sat Flow(s),veh/h/ln	1774	1863	1863	1583	1774	1583
Q Serve(g_s), s	0.3	7.0	12.9	1.8	1.9	0.2
Cycle Q Clear(g_c), s	0.3	7.0	12.9	1.8	1.9	0.2
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	24	1289	1074	913	186	166
V/C Ratio(X)	0.54	0.53	0.76	0.17	0.50	0.05
Avail Cap(c_a), veh/h	180	2652	2274	1932	722	644
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.3	2.9	6.2	3.9	16.6	15.9
Incr Delay (d2), s/veh	17.9	0.3	1.1	0.1	2.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.2	1.8	4.2	0.5	0.9	0.0
Lane Grp Delay (d), s/veh	37.2	3.3	7.4	4.0	18.7	16.0
Lane Grp LOS	D	A	A	A	B	B
Approach Vol, veh/h		696	964		102	
Approach Delay, s/veh		3.9	6.8		18.5	
Approach LOS		A	A		B	

Timer			
Assigned Phs	7	4	8
Phs Duration (G+Y+Rc), s	4.5	31.2	26.7
Change Period (Y+Rc), s	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	56.0	48.0
Max Q Clear Time (g_c+I1), s	2.3	9.0	14.9
Green Ext Time (p_c), s	0.8	5.7	7.8

Intersection Summary	
HCM 2010 Ctrl Delay	6.4
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	500	144	215	666	183	181	230	405	287	220	40
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	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)	1770	1696	1442	1612	1696	1583	1612	1637	1370	1770	1863	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)	1770	1696	1442	1612	1696	1583	1612	1637	1370	1770	1863	1583
Peak-hour factor, PHF	0.92	0.93	0.93	0.93	0.93	0.92	0.93	0.92	0.93	0.92	0.92	0.92
Adj. Flow (vph)	76	538	155	231	716	199	195	250	435	312	239	43
RTOR Reduction (vph)	0	0	72	0	0	110	0	16	258	0	0	33
Lane Group Flow (vph)	76	538	83	231	716	89	195	347	64	312	239	10
Heavy Vehicles (%)	2%	12%	12%	12%	12%	2%	12%	2%	12%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	31.0	31.0	16.0	42.0	42.0	14.9	20.0	20.0	17.0	22.1	22.1
Effective Green, g (s)	5.0	31.0	31.0	16.0	42.0	42.0	14.9	20.0	20.0	17.0	22.1	22.1
Actuated g/C Ratio	0.05	0.31	0.31	0.16	0.42	0.42	0.15	0.20	0.20	0.17	0.22	0.22
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	525	447	257	712	664	240	327	274	300	411	349
v/s Ratio Prot	0.04	c0.32		0.14	c0.42		0.12	c0.21		c0.18	0.13	
v/s Ratio Perm			0.06			0.06			0.05			0.01
v/c Ratio	0.86	1.02	0.18	0.90	1.01	0.13	0.81	1.06	0.24	1.04	0.58	0.03
Uniform Delay, d1	47.2	34.5	25.3	41.2	29.0	17.8	41.2	40.0	33.6	41.5	34.8	30.5
Progression Factor	1.00	1.00	1.00	0.57	0.39	0.19	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	53.6	45.7	0.9	27.3	32.5	0.4	18.5	66.8	0.4	62.7	2.1	0.0
Delay (s)	100.8	80.2	26.2	50.6	43.8	3.7	59.7	106.8	34.0	104.2	36.9	30.6
Level of Service	F	F	C	D	D	A	E	F	C	F	D	C
Approach Delay (s)		71.4			38.2			69.8			71.8	
Approach LOS		E			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	59.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	996	100	275	884	30	120	0	215	80	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1671	4803	1495	1671	3343	1495	1671	1421	1421		1615	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1671	4803	1495	1671	3343	1495	1671	1421	1421		1615	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	103	1083	109	299	961	33	130	0	234	87	0	60
RTOR Reduction (vph)	0	0	63	0	0	16	0	102	102	0	131	0
Lane Group Flow (vph)	103	1083	46	299	961	17	130	15	15	0	16	0
Heavy Vehicles (%)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	13.4	41.8	41.8	22.2	50.6	50.6	12.6	12.6	12.6		7.4	
Effective Green, g (s)	13.4	41.8	41.8	22.2	50.6	50.6	12.6	12.6	12.6		7.4	
Actuated g/C Ratio	0.13	0.42	0.42	0.22	0.51	0.51	0.13	0.13	0.13		0.07	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	223	2007	624	370	1691	756	210	179	179		119	
v/s Ratio Prot	0.06	0.23		c0.18	c0.29		c0.08	0.01			c0.01	
v/s Ratio Perm			0.03			0.01			0.01			
v/c Ratio	0.46	0.54	0.07	0.81	0.57	0.02	0.62	0.08	0.08		0.13	
Uniform Delay, d1	40.0	21.9	17.5	36.9	17.1	12.3	41.4	38.6	38.6		43.3	
Progression Factor	1.02	0.68	0.48	0.86	0.50	1.00	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.6	0.4	0.1	11.7	1.3	0.1	5.3	0.2	0.2		0.5	
Delay (s)	41.2	15.3	8.5	43.3	9.9	12.4	46.8	38.8	38.8		43.8	
Level of Service	D	B	A	D	A	B	D	D	D		D	
Approach Delay (s)		16.8			17.7			41.6			43.8	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	1281	10	25	1179	55	0	0	10	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	7	7	7	7	7	7	7	7	7	7	7	7
Mvmt Flow	0	1334	10	26	1228	57	0	0	10	0	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1285	0	0	1334	0	0	2000	2672	667	1976	2643	643
Stage 1	-	-	-	-	-	-	1334	1334	-	1309	1309	-
Stage 2	-	-	-	-	-	-	666	1338	-	667	1334	-
Follow-up Headway	2.27	-	-	2.27	-	-	3.57	4.07	3.37	3.57	4.07	3.37
Pot Capacity-1 Maneuver	509	-	-	487	-	-	33	20	390	35	21	404
Stage 1	-	-	-	-	-	-	155	212	-	161	218	-
Stage 2	-	-	-	-	-	-	403	211	-	403	212	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	509	-	-	487	-	-	31	19	390	33	20	404
Mov Capacity-2 Maneuver	-	-	-	-	-	-	31	19	-	33	20	-
Stage 1	-	-	-	-	-	-	155	212	-	161	206	-
Stage 2	-	-	-	-	-	-	372	200	-	392	212	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	14.5	14.1
HCM LOS			B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	390	509	-	-	487	-	-	404
HCM Lane V/C Ratio	0.027	-	-	-	0.053	-	-	0.026
HCM Control Delay (s)	14.5	0	-	-	12.809	-	-	14.1
HCM Lane LOS	B	A			B			B
HCM 95th %tile Q(veh)	0.082	0	-	-	0.169	-	-	0.079

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	879	412	200	784	0	0	0	0	85	5	475
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	172.7	172.7	172.7	172.7	0.0				172.7	172.7	172.7
Lanes	0	3	2	1	3	0				2	1	2
Cap, veh/h	0	2436	1380	247	3420	0				830	449	763
Arrive On Green	0.00	0.94	0.94	0.30	1.00	0.00				0.26	0.26	0.26
Sat Flow, veh/h	0	5182	2936	1645	5182	0				3191	1727	2936
Grp Volume(v), veh/h	0	955	448	217	852	0				92	5	516
Grp Sat Flow(s),veh/h/ln	0	1727	1468	1645	1727	0				1596	1727	1468
Q Serve(g_s), s	0.0	1.7	1.3	12.5	0.0	0.0				2.2	0.2	15.8
Cycle Q Clear(g_c), s	0.0	1.7	1.3	12.5	0.0	0.0				2.2	0.2	15.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2436	1380	247	3420	0				830	449	763
V/C Ratio(X)	0.00	0.39	0.32	0.88	0.25	0.00				0.11	0.01	0.68
Avail Cap(c_a), veh/h	0	2436	1380	444	3420	0				830	449	763
HCM Platoon Ratio	1.00	2.00	2.00	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.90	0.90	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	1.6	1.6	34.1	0.0	0.0				28.2	27.5	33.2
Incr Delay (d2), s/veh	0.0	0.5	0.6	8.9	0.2	0.0				0.3	0.0	4.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	0.6	0.4	5.2	0.0	0.0				0.9	0.1	6.3
Lane Grp Delay (d), s/veh	0.0	2.1	2.3	43.1	0.2	0.0				28.5	27.5	38.0
Lane Grp LOS		A	A	D	A					C	C	D
Approach Vol, veh/h		1403			1069						613	
Approach Delay, s/veh		2.2			8.9						36.5	
Approach LOS		A			A						D	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		51.0		19.0	70.0						30.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		35.0		27.0	66.0						26.0	
Max Q Clear Time (g_c+I1), s		3.7		14.5	2.0						17.8	
Green Ext Time (p_c), s		19.8		0.5	28.6						1.7	

Intersection Summary		
HCM 2010 Ctrl Delay		11.3
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	529	435	0	0	614	20	370	100	200	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	172.7	172.7	0.0	0.0	172.7	172.7	172.7	172.7	172.7			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1253	3265	0	0	1658	470	925	501	426			
Arrive On Green	0.45	1.00	0.00	0.00	0.32	0.32	0.29	0.29	0.29			
Sat Flow, veh/h	4639	5182	0	0	5182	1468	3191	1727	1468			
Grp Volume(v), veh/h	575	473	0	0	667	22	402	109	217			
Grp Sat Flow(s),veh/h/ln	1546	1727	0	0	1727	1468	1596	1727	1468			
Q Serve(g_s), s	8.6	0.0	0.0	0.0	10.0	1.0	10.2	4.8	12.3			
Cycle Q Clear(g_c), s	8.6	0.0	0.0	0.0	10.0	1.0	10.2	4.8	12.3			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1253	3265	0	0	1658	470	925	501	426			
V/C Ratio(X)	0.46	0.14	0.00	0.00	0.40	0.05	0.43	0.22	0.51			
Avail Cap(c_a), veh/h	1253	3265	0	0	1658	470	925	501	426			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.90	0.90	0.00	0.00	0.83	0.83	1.00	1.00	1.00			
Uniform Delay (d), s/veh	22.4	0.0	0.0	0.0	26.5	23.5	28.8	26.9	29.6			
Incr Delay (d2), s/veh	0.2	0.1	0.0	0.0	0.6	0.2	1.5	1.0	4.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	2.9	0.0	0.0	0.0	4.4	0.4	4.3	2.2	5.0			
Lane Grp Delay (d), s/veh	22.6	0.1	0.0	0.0	27.1	23.6	30.3	27.9	33.9			
Lane Grp LOS	C	A			C	C	C	C	C			
Approach Vol, veh/h		1048			689			728				
Approach Delay, s/veh		12.5			27.0			31.0				
Approach LOS		B			C			C				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	31.0	67.0			36.0			33.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	27.0	63.0			32.0			29.0				
Max Q Clear Time (g_c+I1), s	10.6	2.0			12.0			14.3				
Green Ext Time (p_c), s	5.2	6.6			4.7			2.6				

Intersection Summary												
HCM 2010 Ctrl Delay			22.0									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	472	0	164	0	0	0	91	20	0	0	70	543
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	174.3	174.3	190.0	174.3	190.0	174.3	174.3	190.0	174.3	174.3	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	641	0	572	0	673	0	125	1639	0	3	563	479
Arrive On Green	0.39	0.00	0.39	0.00	0.00	0.00	0.08	0.47	0.00	0.00	0.32	0.32
Sat Flow, veh/h	1660	0	1482	0	1743	0	1660	3486	0	1660	1743	1482
Grp Volume(v), veh/h	513	0	178	0	0	0	99	22	0	0	76	590
Grp Sat Flow(s),veh/h/ln	1660	0	1482	0	1743	0	1660	1743	0	1660	1743	1482
Q Serve(g_s), s	15.3	0.0	4.7	0.0	0.0	0.0	3.3	0.2	0.0	0.0	1.7	18.0
Cycle Q Clear(g_c), s	15.3	0.0	4.7	0.0	0.0	0.0	3.3	0.2	0.0	0.0	1.7	18.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	641	0	572	0	673	0	125	1639	0	3	563	479
V/C Ratio(X)	0.80	0.00	0.31	0.00	0.00	0.00	0.79	0.01	0.00	0.00	0.13	1.23
Avail Cap(c_a), veh/h	1192	0	1064	0	673	0	298	1639	0	119	563	479
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.00	0.98	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	11.9	0.0	0.0	0.0	25.3	7.9	0.0	0.0	13.3	18.8
Incr Delay (d2), s/veh	2.3	0.0	0.3	0.0	0.0	0.0	10.7	0.0	0.0	0.0	0.5	121.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	6.1	0.0	1.5	0.0	0.0	0.0	1.7	0.1	0.0	0.0	0.8	22.2
Lane Grp Delay (d), s/veh	17.5	0.0	12.2	0.0	0.0	0.0	36.0	7.9	0.0	0.0	13.8	140.4
Lane Grp LOS	B		B				D	A			B	F
Approach Vol, veh/h		691			0			121			666	
Approach Delay, s/veh		16.2			0.0			30.9			126.0	
Approach LOS		B						C			F	

Timer								
Assigned Phs		4			8		5	2		1	6	
Phs Duration (G+Y+Rc), s		25.5			25.5		8.2	30.2		0.0	22.0	
Change Period (Y+Rc), s		4.0			4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s		40.0			16.0		10.0	24.0		4.0	18.0	
Max Q Clear Time (g_c+I1), s		17.3			0.0		5.3	2.2		0.0	20.0	
Green Ext Time (p_c), s		4.2			0.0		0.1	5.2		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	66.9
HCM 2010 LOS	E

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	531	922	305	270	799	310
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	2	1	2	1
Cap, veh/h	687	614	745	317	903	955
Arrive On Green	0.39	0.39	0.20	0.20	0.26	0.51
Sat Flow, veh/h	1774	1583	3725	1583	3442	1863
Grp Volume(v), veh/h	577	1002	332	293	868	337
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	23.6	31.0	6.3	14.5	19.9	8.6
Cycle Q Clear(g_c), s	23.6	31.0	6.3	14.5	19.9	8.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	687	614	745	317	903	955
V/C Ratio(X)	0.84	1.63	0.45	0.93	0.96	0.35
Avail Cap(c_a), veh/h	687	614	745	317	903	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.2	24.5	28.1	31.4	29.1	11.6
Incr Delay (d2), s/veh	9.1	292.3	0.4	31.9	20.9	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	11.7	61.4	2.9	8.4	10.9	3.7
Lane Grp Delay (d), s/veh	31.3	316.8	28.5	63.3	50.0	11.8
Lane Grp LOS	C	F	C	E	D	B
Approach Vol, veh/h	1579		625			1205
Approach Delay, s/veh	212.5		44.8			39.4
Approach LOS	F		D			D

Timer						
Assigned Phs			2		1	6
Phs Duration (G+Y+Rc), s			20.0		25.0	45.0
Change Period (Y+Rc), s			4.0		4.0	4.0
Max Green Setting (Gmax), s			16.0		21.0	41.0
Max Q Clear Time (g_c+I1), s			16.5		21.9	10.6
Green Ext Time (p_c), s			0.0		0.0	6.0

Intersection Summary	
HCM 2010 Ctrl Delay	120.5
HCM 2010 LOS	F

Notes

Intersection	
Intersection Delay, s/veh	27.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	20	1049	1432	39	42	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	1140	1557	42	46	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1599	0	-	0	2762	1578
Stage 1	-	-	-	-	1578	-
Stage 2	-	-	-	-	1184	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	409	-	-	-	# 21	135
Stage 1	-	-	-	-	187	-
Stage 2	-	-	-	-	290	-
Time blocked-Platoon, %		-	-	-		
Mov Capacity-1 Maneuver	409	-	-	-	# 18	135
Mov Capacity-2 Maneuver	-	-	-	-	# 18	-
Stage 1	-	-	-	-	187	-
Stage 2	-	-	-	-	247	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	$ 1115.3
HCM LOS			F

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	409	-	-	-	25
HCM Lane V/C Ratio	0.053	-	-	-	2.739
HCM Control Delay (s)	14.295	0	-	-	$ 1115.3
HCM Lane LOS	B	A			F
HCM 95th %tile Q(veh)	0.168	-	-	-	8.467

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	39	1052	1429	447	484	42
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	1	1	1	1
Cap, veh/h	47	1316	1217	1034	426	380
Arrive On Green	0.03	0.71	0.65	0.65	0.24	0.24
Sat Flow, veh/h	1774	1863	1863	1583	1774	1583
Grp Volume(v), veh/h	42	1143	1553	486	526	46
Grp Sat Flow(s),veh/h/ln	1774	1863	1863	1583	1774	1583
Q Serve(g_s), s	3.5	69.9	98.0	23.0	36.0	3.4
Cycle Q Clear(g_c), s	3.5	69.9	98.0	23.0	36.0	3.4
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	47	1316	1217	1034	426	380
V/C Ratio(X)	0.89	0.87	1.28	0.47	1.24	0.12
Avail Cap(c_a), veh/h	47	1316	1217	1034	426	380
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	72.8	16.7	26.0	13.0	57.0	44.6
Incr Delay (d2), s/veh	89.5	6.5	130.7	0.3	124.8	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	2.8	32.5	87.8	8.7	31.3	3.4
Lane Grp Delay (d), s/veh	162.3	23.2	156.7	13.3	181.8	44.8
Lane Grp LOS	F	C	F	B	F	D
Approach Vol, veh/h		1185	2039		572	
Approach Delay, s/veh		28.1	122.6		170.8	
Approach LOS		C	F		F	

Timer			
Assigned Phs	7	4	8
Phs Duration (G+Y+Rc), s	8.0	110.0	102.0
Change Period (Y+Rc), s	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	106.0	98.0
Max Q Clear Time (g_c+I1), s	5.5	71.9	100.0
Green Ext Time (p_c), s	0.0	32.7	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	100.3
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	1070	306	525	1431	533	300	450	600	718	570	145
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	1163	333	571	1555	579	326	489	652	780	620	158
RTOR Reduction (vph)	0	0	81	0	0	123	0	7	280	0	0	86
Lane Group Flow (vph)	174	1163	252	571	1555	456	326	599	255	780	620	72
Heavy Vehicles (%)	2%	3%	3%	3%	3%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.0	38.0	38.0	23.0	55.0	55.0	10.0	23.0	23.0	20.0	33.0	33.0
Effective Green, g (s)	6.0	38.0	38.0	23.0	55.0	55.0	10.0	23.0	23.0	20.0	33.0	33.0
Actuated g/C Ratio	0.05	0.32	0.32	0.19	0.46	0.46	0.08	0.19	0.19	0.17	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	584	496	335	845	725	146	328	285	295	512	435
v/s Ratio Prot	0.10	c0.63		0.33	c0.84		0.19	c0.35		c0.44	0.33	
v/s Ratio Perm			0.16			0.29			0.17			0.05
v/c Ratio	1.98	1.99	0.51	1.70	1.84	0.63	2.23	1.83	0.89	2.64	1.21	0.17
Uniform Delay, d1	57.0	41.0	33.4	48.5	32.5	24.7	55.0	48.5	47.3	50.0	43.5	33.1
Progression Factor	1.00	1.00	1.00	0.64	0.47	0.16	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	477.9	452.3	3.7	318.2	378.5	0.4	576.3	383.2	27.6	749.5	112.0	0.2
Delay (s)	534.9	493.3	37.1	349.5	393.7	4.4	631.3	431.7	74.9	799.5	155.5	33.2
Level of Service	F	F	D	F	F	A	F	F	E	F	F	C
Approach Delay (s)		406.6			301.1			345.9			465.5	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	368.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	2.09		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	174.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	2197	125	435	2254	65	185	0	320	110	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1725	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1725	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	68	2289	130	453	2348	68	193	0	333	115	0	52
RTOR Reduction (vph)	0	0	72	0	0	29	0	146	145	0	109	0
Lane Group Flow (vph)	68	2289	58	453	2348	39	193	21	21	0	58	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.6	47.0	47.0	32.0	69.4	69.4	15.4	15.4	15.4		9.6	
Effective Green, g (s)	9.6	47.0	47.0	32.0	69.4	69.4	15.4	15.4	15.4		9.6	
Actuated g/C Ratio	0.08	0.39	0.39	0.27	0.58	0.58	0.13	0.13	0.13		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	141	1991	620	472	2046	915	227	193	193		138	
v/s Ratio Prot	0.04	0.45		c0.26	c0.66		c0.11	0.01			c0.03	
v/s Ratio Perm			0.04			0.02			0.01			
v/c Ratio	0.48	1.15	0.09	0.96	1.15	0.04	0.85	0.11	0.11		0.42	
Uniform Delay, d1	52.8	36.5	23.1	43.4	25.3	10.9	51.2	46.2	46.2		52.6	
Progression Factor	1.23	0.48	0.28	1.11	0.73	0.76	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.2	68.0	0.0	21.9	70.2	0.1	25.0	0.3	0.3		2.1	
Delay (s)	65.2	85.7	6.5	70.1	88.7	8.4	76.1	46.5	46.5		54.7	
Level of Service	E	F	A	E	F	A	E	D	D		D	
Approach Delay (s)		81.0			83.9			57.4			54.7	
Approach LOS		F			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	79.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	2612	15	35	2734	85	0	0	15	0	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2779	16	37	2909	90	0	0	16	0	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	2999	0	0	2779	0	0	4308	5852	1389	4417	5807	1499
Stage 1	-	-	-	-	-	-	2779	2779	-	3028	3028	-
Stage 2	-	-	-	-	-	-	1529	3073	-	1389	2779	-
Follow-up Headway	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Capacity-1 Maneuver	113	-	-	139	-	-	1	0	132	0	0	111
Stage 1	-	-	-	-	-	-	19	40	-	13	30	-
Stage 2	-	-	-	-	-	-	123	28	-	150	40	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	113	-	-	139	-	-	1	0	132	0	0	111
Mov Capacity-2 Maneuver	-	-	-	-	-	-	1	0	-	0	0	-
Stage 1	-	-	-	-	-	-	19	40	-	13	22	-
Stage 2	-	-	-	-	-	-	73	21	-	132	40	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.5	36	45
HCM LOS			E	E

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	132	113	-	-	139	-	-	111
HCM Lane V/C Ratio	0.121	-	-	-	0.268	-	-	0.192
HCM Control Delay (s)	36	0	-	-	40.117	-	-	45
HCM Lane LOS	E	A			E			E
HCM 95th %tile Q(veh)	0.401	0	-	-	1.016	-	-	0.671

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1840	788	295	1783	0	0	0	0	55	5	1071
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	182.7	182.7	182.7	182.7	0.0				182.7	182.7	182.7
Lanes	0	3	2	1	3	0				2	1	2
Cap, veh/h	0	2055	1165	290	3151	0				1210	655	1113
Arrive On Green	0.00	0.50	0.50	0.33	1.00	0.00				0.36	0.36	0.36
Sat Flow, veh/h	0	5481	3106	1740	5481	0				3375	1827	3106
Grp Volume(v), veh/h	0	1917	821	307	1857	0				57	5	1116
Grp Sat Flow(s),veh/h/ln	0	1827	1553	1740	1827	0				1688	1827	1553
Q Serve(g_s), s	0.0	39.3	24.5	20.0	0.0	0.0				1.3	0.2	43.0
Cycle Q Clear(g_c), s	0.0	39.3	24.5	20.0	0.0	0.0				1.3	0.2	43.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2055	1165	290	3151	0				1210	655	1113
V/C Ratio(X)	0.00	0.93	0.70	1.06	0.59	0.00				0.05	0.01	1.00
Avail Cap(c_a), veh/h	0	2055	1165	290	3151	0				1210	655	1113
HCM Platoon Ratio	1.00	1.33	1.33	2.00	2.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.34	0.34	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	28.7	24.9	40.0	0.0	0.0				25.1	24.8	38.5
Incr Delay (d2), s/veh	0.0	9.3	3.6	47.6	0.3	0.0				0.1	0.0	27.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	18.6	9.4	11.7	0.1	0.0				0.6	0.1	21.1
Lane Grp Delay (d), s/veh	0.0	37.9	28.5	87.6	0.3	0.0				25.2	24.8	66.1
Lane Grp LOS		D	C	F	A					C	C	F
Approach Vol, veh/h		2738			2164						1178	
Approach Delay, s/veh		35.1			12.7						64.0	
Approach LOS		D			B						E	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		49.0		24.0	73.0						47.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		45.0		20.0	69.0						43.0	
Max Q Clear Time (g_c+I1), s		41.3		22.0	2.0						45.0	
Green Ext Time (p_c), s		3.6		0.0	63.8						0.0	

Intersection Summary												
HCM 2010 Ctrl Delay			32.7									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1112	783	0	0	1172	80	907	135	210	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	181.0	181.0	0.0	0.0	181.0	181.0	181.0	181.0	181.0			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1336	3257	0	0	1583	449	1114	603	513			
Arrive On Green	0.46	1.00	0.00	0.00	0.10	0.10	0.33	0.33	0.33			
Sat Flow, veh/h	4860	5429	0	0	5429	1538	3343	1810	1538			
Grp Volume(v), veh/h	1209	851	0	0	1274	87	986	147	228			
Grp Sat Flow(s),veh/h/ln	1620	1810	0	0	1810	1538	1672	1810	1538			
Q Serve(g_s), s	27.6	0.0	0.0	0.0	27.6	6.3	33.5	7.1	13.9			
Cycle Q Clear(g_c), s	27.6	0.0	0.0	0.0	27.6	6.3	33.5	7.1	13.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1336	3257	0	0	1583	449	1114	603	513			
V/C Ratio(X)	0.90	0.26	0.00	0.00	0.80	0.19	0.88	0.24	0.44			
Avail Cap(c_a), veh/h	1336	3257	0	0	1583	449	1114	603	513			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	0.33	0.33	1.00	1.00	1.00			
Upstream Filter(I)	0.10	0.10	0.00	0.00	0.09	0.09	1.00	1.00	1.00			
Uniform Delay (d), s/veh	31.0	0.0	0.0	0.0	50.9	41.2	37.8	29.0	31.3			
Incr Delay (d2), s/veh	1.0	0.0	0.0	0.0	0.4	0.1	10.3	1.0	2.8			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	10.2	0.0	0.0	0.0	13.6	2.6	15.7	3.4	5.8			
Lane Grp Delay (d), s/veh	32.0	0.0	0.0	0.0	51.3	41.3	48.2	30.0	34.1			
Lane Grp LOS	C	A			D	D	D	C	C			
Approach Vol, veh/h		2060			1361			1361				
Approach Delay, s/veh		18.8			50.7			43.8				
Approach LOS		B			D			D				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	37.0	76.0			39.0			44.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	33.0	72.0			35.0			40.0				
Max Q Clear Time (g_c+I1), s	29.6	2.0			29.6			35.5				
Green Ext Time (p_c), s	2.8	18.5			3.8			2.5				

Intersection Summary												
HCM 2010 Ctrl Delay			35.0									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	748	0	246	0	0	0	240	125	0	0	90	1013
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	182.7	182.7	190.0	182.7	190.0	182.7	182.7	190.0	182.7	182.7	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	898	0	801	0	942	0	296	1441	0	2	328	278
Arrive On Green	0.52	0.00	0.52	0.00	0.00	0.00	0.17	0.39	0.00	0.00	0.18	0.18
Sat Flow, veh/h	1740	0	1553	0	1827	0	1740	3654	0	1740	1827	1553
Grp Volume(v), veh/h	813	0	267	0	0	0	261	136	0	0	98	1101
Grp Sat Flow(s),veh/h/ln	1740	0	1553	0	1827	0	1740	1827	0	1740	1827	1553
Q Serve(g_s), s	37.9	0.0	9.0	0.0	0.0	0.0	13.1	2.1	0.0	0.0	4.2	16.0
Cycle Q Clear(g_c), s	37.9	0.0	9.0	0.0	0.0	0.0	13.1	2.1	0.0	0.0	4.2	16.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	898	0	801	0	942	0	296	1441	0	2	328	278
V/C Ratio(X)	0.91	0.00	0.33	0.00	0.00	0.00	0.88	0.09	0.00	0.00	0.30	3.95
Avail Cap(c_a), veh/h	1053	0	940	0	942	0	331	1441	0	78	328	278
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.00	0.96	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	19.6	0.0	12.6	0.0	0.0	0.0	36.1	17.0	0.0	0.0	31.8	36.6
Incr Delay (d2), s/veh	9.7	0.0	0.2	0.0	0.0	0.0	21.4	0.0	0.0	0.0	0.5	1337.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	18.0	0.0	3.3	0.0	0.0	0.0	7.6	0.9	0.0	0.0	2.0	109.7
Lane Grp Delay (d), s/veh	29.3	0.0	12.9	0.0	0.0	0.0	57.5	17.0	0.0	0.0	32.3	1374.6
Lane Grp LOS	C		B				E	B			C	F
Approach Vol, veh/h		1080			0			397			1199	
Approach Delay, s/veh		25.3			0.0			43.6			1264.8	
Approach LOS		C						D			F	

Timer								
Assigned Phs		4			8		5	2		1	6	
Phs Duration (G+Y+Rc), s		50.0			50.0		19.2	39.2		0.0	20.0	
Change Period (Y+Rc), s		4.0			4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s		54.0			17.0		17.0	29.0		4.0	16.0	
Max Q Clear Time (g_c+I1), s		39.9			0.0		15.1	4.1		0.0	18.0	
Green Ext Time (p_c), s		6.1			0.0		0.2	13.9		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	583.4
HCM 2010 LOS	F

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	423	750	310	295	760	365
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	2	1	2	1
Cap, veh/h	659	588	763	324	930	980
Arrive On Green	0.37	0.37	0.20	0.20	0.27	0.53
Sat Flow, veh/h	1774	1583	3725	1583	3442	1863
Grp Volume(v), veh/h	460	815	337	321	826	397
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	17.2	29.0	6.2	15.8	18.0	10.0
Cycle Q Clear(g_c), s	17.2	29.0	6.2	15.8	18.0	10.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	659	588	763	324	930	980
V/C Ratio(X)	0.70	1.39	0.44	0.99	0.89	0.41
Avail Cap(c_a), veh/h	659	588	763	324	1014	1026
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.8	24.5	27.1	31.0	27.4	11.1
Incr Delay (d2), s/veh	3.3	184.1	0.4	47.0	9.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	8.0	40.9	2.9	10.5	8.7	4.3
Lane Grp Delay (d), s/veh	24.1	208.7	27.5	77.9	36.6	11.4
Lane Grp LOS	C	F	C	E	D	B
Approach Vol, veh/h	1275		658			1223
Approach Delay, s/veh	142.1		52.1			28.4
Approach LOS	F		D			C

Timer					
Assigned Phs			2	1	6
Phs Duration (G+Y+Rc), s			20.0	25.1	45.1
Change Period (Y+Rc), s			4.0	4.0	4.0
Max Green Setting (Gmax), s			16.0	23.0	43.0
Max Q Clear Time (g_c+I1), s			17.8	20.0	12.0
Green Ext Time (p_c), s			0.0	1.1	6.7

Intersection Summary	
HCM 2010 Ctrl Delay	79.3
HCM 2010 LOS	E

Notes

Intersection	
Intersection Delay, s/veh	29.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	30	1025	1145	60	55	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	1114	1245	65	60	30

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1310	0	-	0	2456	1277
Stage 1	-	-	-	-	1277	-
Stage 2	-	-	-	-	1179	-
Follow-up Headway	2.218	-	-	-	3.518	3.318
Pot Capacity-1 Maneuver	528	-	-	-	# 34	203
Stage 1	-	-	-	-	262	-
Stage 2	-	-	-	-	292	-
Time blocked-Platoon, %		-	-	-		
Mov Capacity-1 Maneuver	528	-	-	-	# 28	203
Mov Capacity-2 Maneuver	-	-	-	-	# 28	-
Stage 1	-	-	-	-	262	-
Stage 2	-	-	-	-	244	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	$ 821
HCM LOS			F

Minor Lane / Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	528	-	-	-	39
HCM Lane V/C Ratio	0.062	-	-	-	2.313
HCM Control Delay (s)	12.267	0	-	-	$ 821
HCM Lane LOS	B	A			F
HCM 95th %tile Q(veh)	0.197	-	-	-	9.84

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	60	1020	1150	690	637	55
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	1	1	1	1	1
Cap, veh/h	47	1155	1056	897	580	517
Arrive On Green	0.03	0.62	0.57	0.57	0.33	0.33
Sat Flow, veh/h	1774	1863	1863	1583	1774	1583
Grp Volume(v), veh/h	65	1109	1250	750	692	60
Grp Sat Flow(s),veh/h/ln	1774	1863	1863	1583	1774	1583
Q Serve(g_s), s	4.0	83.9	85.0	58.5	49.0	4.0
Cycle Q Clear(g_c), s	4.0	83.9	85.0	58.5	49.0	4.0
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	47	1155	1056	897	580	517
V/C Ratio(X)	1.37	0.96	1.18	0.84	1.19	0.12
Avail Cap(c_a), veh/h	47	1155	1056	897	580	517
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	73.0	26.8	32.5	26.8	50.5	35.3
Incr Delay (d2), s/veh	259.1	17.7	92.7	6.9	103.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	5.3	43.6	66.2	24.6	39.0	4.2
Lane Grp Delay (d), s/veh	332.1	44.5	125.2	33.7	154.0	35.4
Lane Grp LOS	F	D	F	C	F	D
Approach Vol, veh/h		1174	2000		752	
Approach Delay, s/veh		60.4	90.9		144.5	
Approach LOS		E	F		F	

Timer			
Assigned Phs	7	4	8
Phs Duration (G+Y+Rc), s	8.0	97.0	89.0
Change Period (Y+Rc), s	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	93.0	85.0
Max Q Clear Time (g_c+I1), s	6.0	85.9	87.0
Green Ext Time (p_c), s	0.0	6.9	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	92.0
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	1134	383	620	1364	574	375	480	645	682	590	100
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	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	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)	1770	1845	1568	1752	1845	1583	1752	1715	1490	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	1233	416	674	1483	624	408	522	701	741	641	109
RTOR Reduction (vph)	0	0	81	0	0	139	0	7	293	0	0	81
Lane Group Flow (vph)	152	1233	335	674	1483	485	408	641	282	741	641	28
Heavy Vehicles (%)	2%	3%	3%	3%	3%	2%	3%	2%	3%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.0	38.0	38.0	24.0	56.0	56.0	11.0	24.0	24.0	18.0	31.0	31.0
Effective Green, g (s)	6.0	38.0	38.0	24.0	56.0	56.0	11.0	24.0	24.0	18.0	31.0	31.0
Actuated g/C Ratio	0.05	0.32	0.32	0.20	0.47	0.47	0.09	0.20	0.20	0.15	0.26	0.26
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	88	584	496	350	861	738	160	343	298	265	481	408
v/s Ratio Prot	0.09	c0.67		c0.38	0.80		0.23	c0.37		c0.42	0.34	
v/s Ratio Perm			0.21			0.31			0.19			0.02
v/c Ratio	1.73	2.11	0.68	1.93	1.72	0.66	2.55	1.87	0.95	2.80	1.33	0.07
Uniform Delay, d1	57.0	41.0	35.6	48.0	32.0	24.6	54.5	48.0	47.4	51.0	44.5	33.6
Progression Factor	1.00	1.00	1.00	1.03	0.52	0.21	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	370.2	505.9	7.2	417.5	325.5	0.4	715.5	401.7	37.8	818.7	163.4	0.1
Delay (s)	427.2	546.9	42.9	467.1	342.3	5.6	770.0	449.7	85.1	869.7	207.9	33.7
Level of Service	F	F	D	F	F	A	F	F	F	F	F	C
Approach Delay (s)		420.4			297.0			401.3			524.1	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	391.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	2.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	183.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	2191	190	600	2203	70	280	0	475	110	0	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1710	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	5085	1583	1770	3539	1583	1770	1504	1504		1710	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	83	2282	198	625	2295	73	292	0	495	115	0	78
RTOR Reduction (vph)	0	0	73	0	0	32	0	215	214	0	107	0
Lane Group Flow (vph)	83	2282	125	625	2295	41	292	33	33	0	86	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	9.1	47.1	47.1	30.0	68.0	68.0	16.0	16.0	16.0		10.9	
Effective Green, g (s)	9.1	47.1	47.1	30.0	68.0	68.0	16.0	16.0	16.0		10.9	
Actuated g/C Ratio	0.08	0.39	0.39	0.25	0.57	0.57	0.13	0.13	0.13		0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	134	1995	621	442	2005	897	236	200	200		155	
v/s Ratio Prot	0.05	c0.45		c0.35	0.65		c0.17	0.02			c0.05	
v/s Ratio Perm			0.08			0.03			0.02			
v/c Ratio	0.62	1.14	0.20	1.41	1.14	0.05	1.24	0.17	0.16		0.55	
Uniform Delay, d1	53.8	36.5	24.0	45.0	26.0	11.6	52.0	46.1	46.1		52.2	
Progression Factor	0.95	0.66	0.78	0.90	0.82	0.70	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.8	65.4	0.1	187.6	65.7	0.0	137.6	0.4	0.4		4.2	
Delay (s)	51.6	89.4	18.8	228.1	87.2	8.1	189.6	46.5	46.5		56.4	
Level of Service	D	F	B	F	F	A	F	D	D		E	
Approach Delay (s)		82.7			114.7			99.6			56.4	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	98.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	115.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	2756	20	55	2853	90	0	0	20	0	0	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2932	21	59	3035	96	0	0	21	0	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	3131	0	0	2932	0	0	4567	6180	1466	4666	6132	1565
Stage 1	-	-	-	-	-	-	2932	2932	-	3200	3200	-
Stage 2	-	-	-	-	-	-	1635	3248	-	1466	2932	-
Follow-up Headway	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Capacity-1 Maneuver	100	-	-	120	-	-	0	0	117	0	0	100
Stage 1	-	-	-	-	-	-	15	33	-	10	24	-
Stage 2	-	-	-	-	-	-	105	23	-	134	33	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	100	-	-	120	-	-	0	0	117	0	0	100
Mov Capacity-2 Maneuver	-	-	-	-	-	-	0	0	-	0	0	-
Stage 1	-	-	-	-	-	-	15	33	-	10	12	-
Stage 2	-	-	-	-	-	-	42	12	-	110	33	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	42.5	50.5
HCM LOS			E	F

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	117	100	-	-	120	-	-	100
HCM Lane V/C Ratio	0.182	-	-	-	0.488	-	-	0.213
HCM Control Delay (s)	42.5	0	-	-	60.686	-	-	50.5
HCM Lane LOS	E	A			F			F
HCM 95th %tile Q(veh)	0.633	0	-	-	2.216	-	-	0.753

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1878	898	220	1889	0	0	0	0	110	5	1109
Number	7	4	14	3	8	18				1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow veh/h/ln	0.0	182.7	182.7	182.7	182.7	0.0				182.7	182.7	182.7
Lanes	0	3	2	1	2	0				2	1	2
Cap, veh/h	0	2101	1191	232	2010	0				1294	700	1191
Arrive On Green	0.00	0.77	0.77	0.18	0.73	0.00				0.38	0.38	0.38
Sat Flow, veh/h	0	5481	3106	1740	3654	0				3375	1827	3106
Grp Volume(v), veh/h	0	1956	935	229	1968	0				115	5	1155
Grp Sat Flow(s),veh/h/ln	0	1827	1553	1740	1827	0				1688	1827	1553
Q Serve(g_s), s	0.0	34.9	21.2	15.8	61.2	0.0				2.6	0.2	43.8
Cycle Q Clear(g_c), s	0.0	34.9	21.2	15.8	61.2	0.0				2.6	0.2	43.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	2101	1191	232	2010	0				1294	700	1191
V/C Ratio(X)	0.00	0.93	0.79	0.99	0.98	0.00				0.09	0.01	0.97
Avail Cap(c_a), veh/h	0	2101	1191	232	2010	0				1294	700	1191
HCM Platoon Ratio	1.00	2.00	2.00	1.33	1.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.31	0.31	0.00				1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	12.7	11.1	49.3	15.5	0.0				23.6	22.9	36.3
Incr Delay (d2), s/veh	0.0	9.0	5.2	29.3	7.3	0.0				0.1	0.0	19.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.0	10.4	5.3	8.8	23.9	0.0				1.1	0.1	20.3
Lane Grp Delay (d), s/veh	0.0	21.7	16.4	78.6	22.7	0.0				23.8	22.9	56.2
Lane Grp LOS		C	B	E	C					C	C	E
Approach Vol, veh/h		2891			2197						1275	
Approach Delay, s/veh		20.0			28.6						53.1	
Approach LOS		B			C						D	

Timer												
Assigned Phs		4		3	8						6	
Phs Duration (G+Y+Rc), s		50.0		20.0	70.0						50.0	
Change Period (Y+Rc), s		4.0		4.0	4.0						4.0	
Max Green Setting (Gmax), s		46.0		16.0	66.0						46.0	
Max Q Clear Time (g_c+I1), s		36.9		17.8	63.2						45.8	
Green Ext Time (p_c), s		9.0		0.0	2.8						0.1	

Intersection Summary			
HCM 2010 Ctrl Delay		29.6	
HCM 2010 LOS		C	

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1179	810	0	0	1214	50	896	95	150	0	0	0
Number	7	4	14	3	8	18	5	2	12			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Adj Sat Flow veh/h/ln	181.0	181.0	0.0	0.0	181.0	181.0	181.0	181.0	181.0			
Lanes	3	3	0	0	3	1	2	1	1			
Cap, veh/h	1377	3348	0	0	1629	461	1059	573	487			
Arrive On Green	0.47	1.00	0.00	0.00	0.10	0.10	0.32	0.32	0.32			
Sat Flow, veh/h	4860	5429	0	0	5429	1538	3343	1810	1538			
Grp Volume(v), veh/h	1228	844	0	0	1265	52	933	99	156			
Grp Sat Flow(s),veh/h/ln	1620	1810	0	0	1810	1538	1672	1810	1538			
Q Serve(g_s), s	27.6	0.0	0.0	0.0	27.3	3.7	31.7	4.7	9.3			
Cycle Q Clear(g_c), s	27.6	0.0	0.0	0.0	27.3	3.7	31.7	4.7	9.3			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1377	3348	0	0	1629	461	1059	573	487			
V/C Ratio(X)	0.89	0.25	0.00	0.00	0.78	0.11	0.88	0.17	0.32			
Avail Cap(c_a), veh/h	1377	3348	0	0	1629	461	1059	573	487			
HCM Platoon Ratio	1.67	1.67	1.00	1.00	0.33	0.33	1.00	1.00	1.00			
Upstream Filter(I)	0.16	0.16	0.00	0.00	0.09	0.09	1.00	1.00	1.00			
Uniform Delay (d), s/veh	29.9	0.0	0.0	0.0	50.1	39.5	38.9	29.6	31.2			
Incr Delay (d2), s/veh	1.4	0.0	0.0	0.0	0.3	0.0	10.5	0.7	1.7			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile Back of Q (50%), veh/ln	10.2	0.0	0.0	0.0	13.5	1.5	15.0	2.3	3.8			
Lane Grp Delay (d), s/veh	31.3	0.0	0.0	0.0	50.5	39.6	49.4	30.3	32.9			
Lane Grp LOS	C	A			D	D	D	C	C			
Approach Vol, veh/h		2072			1317			1188				
Approach Delay, s/veh		18.6			50.1			45.6				
Approach LOS		B			D			D				

Timer												
Assigned Phs	7	4			8			2				
Phs Duration (G+Y+Rc), s	38.0	78.0			40.0			42.0				
Change Period (Y+Rc), s	4.0	4.0			4.0			4.0				
Max Green Setting (Gmax), s	34.0	74.0			36.0			38.0				
Max Q Clear Time (g_c+I1), s	29.6	2.0			29.3			33.7				
Green Ext Time (p_c), s	3.5	18.7			4.4			2.1				

Intersection Summary												
HCM 2010 Ctrl Delay			34.7									
HCM 2010 LOS			C									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	732	0	228	0	0	0	235	125	0	0	90	1029
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	190.0	182.7	182.7	190.0	182.7	190.0	182.7	182.7	190.0	182.7	182.7	190.0
Lanes	0	1	1	0	1	0	1	2	0	1	2	0
Cap, veh/h	876	0	782	0	920	0	289	244	0	518	363	308
Arrive On Green	0.50	0.00	0.50	0.00	0.00	0.00	0.17	0.07	0.00	0.00	0.20	0.20
Sat Flow, veh/h	1740	0	1553	0	1827	0	1740	3654	0	1740	1827	1553
Grp Volume(v), veh/h	796	0	248	0	0	0	255	136	0	0	98	1118
Grp Sat Flow(s),veh/h/ln	1740	0	1553	0	1827	0	1740	1827	0	1740	1827	1553
Q Serve(g_s), s	38.0	0.0	8.6	0.0	0.0	0.0	13.0	3.3	0.0	0.0	4.1	18.0
Cycle Q Clear(g_c), s	38.0	0.0	8.6	0.0	0.0	0.0	13.0	3.3	0.0	0.0	4.1	18.0
Prop In Lane	1.00		1.00	0.00		0.00	1.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	876	0	782	0	920	0	289	244	0	518	363	308
V/C Ratio(X)	0.91	0.00	0.32	0.00	0.00	0.00	0.88	0.56	0.00	0.00	0.27	3.63
Avail Cap(c_a), veh/h	1017	0	907	0	920	0	307	1208	0	518	363	308
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.97	0.00	0.97	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	20.6	0.0	13.3	0.0	0.0	0.0	37.0	41.0	0.0	0.0	30.8	36.4
Incr Delay (d2), s/veh	10.4	0.0	0.2	0.0	0.0	0.0	23.8	2.0	0.0	0.0	0.4	1190.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	18.2	0.0	3.2	0.0	0.0	0.0	7.6	1.6	0.0	0.0	1.9	108.9
Lane Grp Delay (d), s/veh	31.1	0.0	13.5	0.0	0.0	0.0	60.8	43.0	0.0	0.0	31.2	1227.0
Lane Grp LOS	C		B				E	D			C	F
Approach Vol, veh/h		1044			0			391			1216	
Approach Delay, s/veh		26.9			0.0			54.6			1130.6	
Approach LOS		C						D			F	

Timer								
Assigned Phs		4		8	5	2	1	6
Phs Duration (G+Y+Rc), s		49.7		49.7	19.1	10.0	31.0	22.0
Change Period (Y+Rc), s		4.0		4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s		53.0		17.0	16.0	30.0	4.0	18.0
Max Q Clear Time (g_c+I1), s		40.0		0.0	15.0	5.3	0.0	20.0
Green Ext Time (p_c), s		5.7		0.0	0.1	0.8	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	537.2
HCM 2010 LOS	F

Notes

Synchro Level Of Service Reports

- Existing + Project Conditions Mitigations
- Cumulative Plus Project Conditions Mitigations

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	8	899	4	15	826	60	6	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	956	4	16	879	64	6	0	13

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	943	0	0	956	0	0	1444	1947	478
Stage 1	-	-	-	-	-	-	973	973	-
Stage 2	-	-	-	-	-	-	471	974	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	723	-	-	715	-	-	93	64	534
Stage 1	-	-	-	-	-	-	271	329	-
Stage 2	-	-	-	-	-	-	542	328	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	723	-	-	715	-	-	88	62	534
Mov Cap-2 Maneuver	-	-	-	-	-	-	88	62	-
Stage 1	-	-	-	-	-	-	268	325	-
Stage 2	-	-	-	-	-	-	516	321	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0.2	25
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	199	723	-	-	715	-	-	539
HCM Lane V/C Ratio	0.096	0.012	-	-	0.022	-	-	0.026
HCM Control Delay (s)	25	10	-	-	10.2	-	-	11.9
HCM Lane LOS	D	B	-	-	B	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.1

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	13
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	0
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	94	94	94
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	14

Major/Minor	Minor2		
Conflicting Flow All	1438	1916	471
Stage 1	943	943	-
Stage 2	495	973	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	94	67	539
Stage 1	282	339	-
Stage 2	525	329	-
Platoon blocked, %			
Mov Cap-1 Maneuver	89	65	539
Mov Cap-2 Maneuver	89	65	-
Stage 1	278	331	-
Stage 2	506	325	-

Approach	SB
HCM Control Delay, s	11.9
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	9	1126	0	4	1126	65	2	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	50	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	1185	0	4	1185	68	2	0	12

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	1254	0	0	1185	0	0	1805	2466	593
Stage 1	-	-	-	-	-	-	1204	1204	-
Stage 2	-	-	-	-	-	-	601	1262	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32
Pot Cap-1 Maneuver	551	-	-	585	-	-	50	30	449
Stage 1	-	-	-	-	-	-	195	255	-
Stage 2	-	-	-	-	-	-	454	239	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	551	-	-	585	-	-	47	29	449
Mov Cap-2 Maneuver	-	-	-	-	-	-	47	29	-
Stage 1	-	-	-	-	-	-	192	251	-
Stage 2	-	-	-	-	-	-	431	237	-

Approach	EB	WB	NB
HCM Control Delay, s	0.1	0	25
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	194	551	-	-	585	-	-	426
HCM Lane V/C Ratio	0.071	0.017	-	-	0.007	-	-	0.044
HCM Control Delay (s)	25	11.6	-	-	11.2	-	-	13.8
HCM Lane LOS	D	B	-	-	B	-	-	B
HCM 95th %tile Q(veh)	0.2	0.1	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	18
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	-	-	0
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	95	95	95
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	0	19

Major/Minor	Minor2		
Conflicting Flow All	1840	2432	627
Stage 1	1228	1228	-
Stage 2	612	1204	-
Critical Hdwy	7.54	6.54	6.94
Critical Hdwy Stg 1	6.54	5.54	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	3.32
Pot Cap-1 Maneuver	47	31	426
Stage 1	189	249	-
Stage 2	447	255	-
Platoon blocked, %			
Mov Cap-1 Maneuver	45	30	426
Mov Cap-2 Maneuver	45	30	-
Stage 1	186	247	-
Stage 2	428	251	-

Approach	SB
HCM Control Delay, s	13.8
HCM LOS	B

Minor Lane/Major Mvmt

HCM Signalized Intersection Capacity Analysis
4: Dover & Woollomes

Cum + Proj - AM (Mitt)

10/30/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	500	144	215	666	183	181	230	405	287	220	40
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	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	0.88	0.97	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	4631	1442	3127	4631	1583	3127	3539	2538	3433	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	4631	1442	3127	4631	1583	3127	3539	2538	3433	3539	1583
Peak-hour factor, PHF	0.92	0.93	0.93	0.93	0.93	0.92	0.93	0.92	0.93	0.92	0.92	0.92
Adj. Flow (vph)	76	538	155	231	716	199	195	250	435	312	239	43
RTOR Reduction (vph)	0	0	106	0	0	106	0	0	370	0	0	35
Lane Group Flow (vph)	76	538	49	231	716	93	195	250	65	312	239	8
Heavy Vehicles (%)	2%	12%	12%	12%	12%	2%	12%	2%	12%	2%	2%	2%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.4	28.6	28.6	18.8	42.0	42.0	10.4	13.4	13.4	13.2	16.2	16.2
Effective Green, g (s)	5.4	28.6	28.6	18.8	42.0	42.0	10.4	13.4	13.4	13.2	16.2	16.2
Actuated g/C Ratio	0.06	0.32	0.32	0.21	0.47	0.47	0.12	0.15	0.15	0.15	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	205	1471	458	653	2161	738	361	526	377	503	637	284
v/s Ratio Prot	0.02	c0.12		0.07	c0.15		0.06	c0.07		c0.09	c0.07	
v/s Ratio Perm			0.03			0.06			0.03			0.00
v/c Ratio	0.37	0.37	0.11	0.35	0.33	0.13	0.54	0.48	0.17	0.62	0.38	0.03
Uniform Delay, d1	40.7	23.7	21.7	30.4	15.1	13.6	37.5	35.1	33.5	36.0	32.4	30.4
Progression Factor	1.00	1.00	1.00	0.50	0.33	0.08	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.7	0.5	0.3	0.4	0.3	1.7	0.7	0.2	2.4	0.4	0.0
Delay (s)	41.8	24.4	22.2	15.6	5.4	1.4	39.2	35.8	33.7	38.4	32.8	30.4
Level of Service	D	C	C	B	A	A	D	D	C	D	C	C
Approach Delay (s)		25.7			6.7			35.5			35.6	
Approach LOS		C			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	23.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	472	0	164	0	0	0	91	20	0	0	70	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95			0.95	
Frt	1.00	1.00	0.85				1.00	1.00			0.87	
Flt Protected	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)	1573	1573	1482				1656	3312			2872	
Flt Permitted	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (perm)	1573	1573	1482				1656	3312			2872	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	513	0	178	0	0	0	99	22	0	0	76	590
RTOR Reduction (vph)	0	0	138	0	0	0	0	0	0	0	271	0
Lane Group Flow (vph)	256	257	40	0	0	0	99	22	0	0	395	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%
Turn Type	Split	NA	Perm	Split			Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	20.0	20.0	20.0				9.4	62.0			48.6	
Effective Green, g (s)	20.0	20.0	20.0				9.4	62.0			48.6	
Actuated g/C Ratio	0.22	0.22	0.22				0.10	0.69			0.54	
Clearance Time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0			3.0	
Lane Grp Cap (vph)	349	349	329				172	2281			1550	
v/s Ratio Prot	0.16	c0.16					c0.06	0.01			c0.14	
v/s Ratio Perm			0.03									
v/c Ratio	0.73	0.74	0.12				0.58	0.01			0.25	
Uniform Delay, d1	32.5	32.5	28.0				38.4	4.4			11.0	
Progression Factor	0.66	0.66	0.71				1.00	1.00			1.00	
Incremental Delay, d2	7.7	7.8	0.2				4.6	0.0			0.4	
Delay (s)	29.1	29.2	20.1				43.0	4.4			11.4	
Level of Service	C	C	C				D	A			B	
Approach Delay (s)		26.8			0.0			36.0			11.4	
Approach LOS		C			A			D			B	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	531	922	305	270	799	310
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	2	2	1	2	1
Cap, veh/h	647	1156	766	325	948	992
Arrive On Green	0.36	0.36	0.21	0.21	0.28	0.53
Sat Flow, veh/h	1774	3167	3725	1583	3442	1863
Grp Volume(v), veh/h	577	1002	332	293	868	337
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	23.8	22.9	6.1	14.0	19.0	8.0
Cycle Q Clear(g_c), s	23.8	22.9	6.1	14.0	19.0	8.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	647	1156	766	325	948	992
V/C Ratio(X)	0.89	0.87	0.43	0.90	0.92	0.34
Avail Cap(c_a), veh/h	684	1220	766	325	972	1005
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.3	23.0	27.0	30.2	27.3	10.4
Incr Delay (d2), s/veh	13.5	6.6	0.4	26.5	12.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	12.5	9.6	2.8	7.9	9.6	3.4
Lane Grp Delay (d), s/veh	36.8	29.6	27.4	56.7	40.1	10.6
Lane Grp LOS	D	C	C	E	D	B
Approach Vol, veh/h	1579		625			1205
Approach Delay, s/veh	32.2		41.1			31.9
Approach LOS	C		D			C

Timer						
Assigned Phs			2		1	6
Phs Duration (G+Y+Rc), s			20.0		25.4	45.4
Change Period (Y+Rc), s			4.0		4.0	4.0
Max Green Setting (Gmax), s			16.0		22.0	42.0
Max Q Clear Time (g_c+I1), s			16.0		21.0	10.0
Green Ext Time (p_c), s			0.0		0.4	6.0

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	20	1049	1432	39	42	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	1.00		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3539	3525		1722	
Flt Permitted	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3539	3525		1722	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	1140	1557	42	46	23
RTOR Reduction (vph)	0	0	2	0	21	0
Lane Group Flow (vph)	22	1140	1597	0	48	0
Turn Type	Prot	NA	NA		NA	
Protected Phases	7	4	8		6	
Permitted Phases						
Actuated Green, G (s)	1.3	51.4	46.1		5.9	
Effective Green, g (s)	1.3	51.4	46.1		5.9	
Actuated g/C Ratio	0.02	0.79	0.71		0.09	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	35	2785	2488		155	
v/s Ratio Prot	0.01	c0.32	c0.45		c0.03	
v/s Ratio Perm						
v/c Ratio	0.63	0.41	0.64		0.31	
Uniform Delay, d1	31.8	2.2	5.2		27.8	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	30.3	0.1	0.6		1.1	
Delay (s)	62.1	2.3	5.7		28.9	
Level of Service	E	A	A		C	
Approach Delay (s)		3.4	5.7		28.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	39	1052	1429	447	484	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	3413	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1770	3539	3539	1583	3413	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	1143	1553	486	526	46
RTOR Reduction (vph)	0	0	0	201	9	0
Lane Group Flow (vph)	42	1143	1553	285	563	0
Turn Type	Prot	NA	NA	Perm	NA	
Protected Phases	7	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	2.1	48.7	42.6	42.6	15.9	
Effective Green, g (s)	2.1	48.7	42.6	42.6	15.9	
Actuated g/C Ratio	0.03	0.67	0.59	0.59	0.22	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	2373	2076	928	747	
v/s Ratio Prot	0.02	c0.32	c0.44		c0.17	
v/s Ratio Perm				0.18		
v/c Ratio	0.82	0.48	0.75	0.31	0.75	
Uniform Delay, d1	35.1	5.8	11.0	7.6	26.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	64.6	0.2	1.5	0.2	4.3	
Delay (s)	99.7	6.0	12.6	7.8	30.9	
Level of Service	F	A	B	A	C	
Approach Delay (s)		9.3	11.4		30.9	
Approach LOS		A	B		C	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	160	1070	306	525	1431	533	300	450	600	718	570	145
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	184.5	184.5	184.5	184.5	186.3	184.5	186.3	184.5	186.3	186.3	186.3
Lanes	2	3	1	2	3	1	2	2	2	2	2	1
Cap, veh/h	228	1490	422	656	2189	626	678	596	501	838	762	324
Arrive On Green	0.07	0.27	0.27	0.39	0.79	0.79	0.20	0.16	0.16	0.24	0.20	0.20
Sat Flow, veh/h	3442	5534	1568	3408	5534	1583	3408	3725	3136	3442	3725	1583
Grp Volume(v), veh/h	174	1163	333	571	1555	579	326	489	652	780	620	158
Grp Sat Flow(s),veh/h/ln	1721	1845	1568	1704	1845	1583	1704	1863	1568	1721	1863	1583
Q Serve(g_s), s	5.9	23.1	23.4	18.4	15.9	16.4	10.1	15.1	19.0	26.3	18.9	8.7
Cycle Q Clear(g_c), s	5.9	23.1	23.4	18.4	15.9	16.4	10.1	15.1	19.0	26.3	18.9	8.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	228	1490	422	656	2189	626	678	596	501	838	762	324
V/C Ratio(X)	0.76	0.78	0.79	0.87	0.71	0.92	0.48	0.82	1.30	0.93	0.81	0.49
Avail Cap(c_a), veh/h	232	1490	422	660	2189	626	678	596	501	869	972	413
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.79	0.79	0.79	0.59	0.59	0.59	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.5	40.2	40.3	35.2	9.2	2.6	42.2	48.3	49.9	44.0	45.1	28.9
Incr Delay (d2), s/veh	11.1	3.3	11.3	7.6	1.2	14.6	0.5	9.0	149.2	16.0	4.3	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	3.0	11.3	10.7	7.6	3.8	4.3	4.5	8.0	18.0	13.5	9.5	3.6
Lane Grp Delay (d), s/veh	65.6	43.5	51.6	42.8	10.4	17.2	42.7	57.2	199.1	59.9	49.4	30.0
Lane Grp LOS	E	D	D	D	B	B	D	E	F	E	D	C
Approach Vol, veh/h		1670			2705			1467			1558	
Approach Delay, s/veh		47.4			18.7			117.1			52.7	
Approach LOS		D			B			F			D	

Timer												
Assigned Phs	7	4		3	8		5	2		1	6	
Phs Duration (G+Y+Rc), s	11.9	36.0		26.9	51.0		27.6	23.0		32.9	28.3	
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s	8.0	32.0		23.0	47.0		18.0	19.0		30.0	31.0	
Max Q Clear Time (g_c+I1), s	7.9	25.4		20.4	18.4		12.1	21.0		28.3	20.9	
Green Ext Time (p_c), s	0.0	4.5		2.4	20.5		2.4	0.0		0.6	3.4	

Intersection Summary	
HCM 2010 Ctrl Delay	51.8
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	2197	125	470	2254	65	185	0	320	110	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1770	1504	1504		1725	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	1770	1504	1504		1725	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	68	2289	130	490	2348	68	193	0	333	115	0	52
RTOR Reduction (vph)	0	0	58	0	0	26	0	146	145	0	109	0
Lane Group Flow (vph)	68	2289	72	490	2348	43	193	21	21	0	58	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	4.0	61.2	61.2	17.8	75.0	75.0	15.4	15.4	15.4		9.6	
Effective Green, g (s)	4.0	61.2	61.2	17.8	75.0	75.0	15.4	15.4	15.4		9.6	
Actuated g/C Ratio	0.03	0.51	0.51	0.15	0.62	0.62	0.13	0.13	0.13		0.08	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	114	2593	807	509	3178	989	227	193	193		138	
v/s Ratio Prot	0.02	c0.45		c0.14	0.46		c0.11	0.01			c0.03	
v/s Ratio Perm			0.05			0.03			0.01			
v/c Ratio	0.60	0.88	0.09	0.96	0.74	0.04	0.85	0.11	0.11		0.42	
Uniform Delay, d1	57.2	26.2	15.1	50.8	15.7	8.7	51.2	46.2	46.2		52.6	
Progression Factor	0.90	0.29	0.07	0.88	0.47	0.39	1.00	1.00	1.00		1.00	
Incremental Delay, d2	4.4	2.6	0.1	21.6	0.9	0.0	25.0	0.3	0.3		2.1	
Delay (s)	56.1	10.3	1.2	66.5	8.3	3.4	76.1	46.5	46.5		54.7	
Level of Service	E	B	A	E	A	A	E	D	D		D	
Approach Delay (s)		11.1			18.0			57.4			54.7	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	2612	15	0	2769	85	0	0	15	0	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	2779	16	0	2946	90	0	0	16	0	0	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		485			250							
pX, platoon unblocked	0.75			0.50			0.63	0.63	0.50	0.63	0.63	0.75
vC, conflicting volume	3036			2795			3782	5815	1389	4396	5786	1027
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2538			2590			1820	5057	0	2799	5011	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
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 %	100			100			100	100	97	100	100	97
cM capacity (veh/h)	129			83			30	0	543	5	0	809

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	1389	1389	16	1178	1178	680	16	21
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	16	0	0	90	16	21
cSH	1700	1700	1700	1700	1700	1700	543	809
Volume to Capacity	0.82	0.82	0.01	0.69	0.69	0.40	0.03	0.03
Queue Length 95th (ft)	0	0	0	0	0	0	2	2
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	11.8	9.6
Lane LOS							B	A
Approach Delay (s)	0.0			0.0			11.8	9.6
Approach LOS							B	A

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	748	0	246	0	0	0	240	125	0	0	90	1013
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95			0.95	
Frt	1.00	1.00	0.85				1.00	1.00			0.86	
Flt Protected	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)	1649	1649	1553				1736	3471			2993	
Flt Permitted	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (perm)	1649	1649	1553				1736	3471			2993	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	813	0	267	0	0	0	261	136	0	0	98	1101
RTOR Reduction (vph)	0	0	191	0	0	0	0	0	0	0	672	0
Lane Group Flow (vph)	406	407	76	0	0	0	261	136	0	0	527	0
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Split	NA	Perm	Split			Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	34.0	34.0	34.0				21.2	50.4			25.2	
Effective Green, g (s)	34.0	34.0	34.0				21.2	50.4			25.2	
Actuated g/C Ratio	0.28	0.28	0.28				0.18	0.42			0.21	
Clearance Time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0			3.0	
Lane Grp Cap (vph)	467	467	440				306	1457			628	
v/s Ratio Prot	0.25	c0.25					c0.15	0.04			c0.18	
v/s Ratio Perm			0.05									
v/c Ratio	0.87	0.87	0.17				0.85	0.09			1.10dr	
Uniform Delay, d1	40.9	40.9	32.4				47.9	21.0			45.5	
Progression Factor	0.52	0.52	0.24				1.00	1.00			1.00	
Incremental Delay, d2	15.3	15.8	0.2				19.9	0.0			9.6	
Delay (s)	36.5	36.9	7.9				67.8	21.0			55.0	
Level of Service	D	D	A				E	C			E	
Approach Delay (s)		29.6			0.0			51.8			55.0	
Approach LOS		C			A			D			E	

Intersection Summary			
HCM 2000 Control Delay	44.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	423	750	310	295	760	365
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	1	2	2	1	2	1
Cap, veh/h	568	1014	846	359	970	1054
Arrive On Green	0.32	0.32	0.23	0.23	0.28	0.57
Sat Flow, veh/h	1774	3167	3725	1583	3442	1863
Grp Volume(v), veh/h	460	815	337	321	826	397
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1721	1863
Q Serve(g_s), s	16.7	16.5	5.4	13.8	15.9	8.2
Cycle Q Clear(g_c), s	16.7	16.5	5.4	13.8	15.9	8.2
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	568	1014	846	359	970	1054
V/C Ratio(X)	0.81	0.80	0.40	0.89	0.85	0.38
Avail Cap(c_a), veh/h	708	1264	850	361	1177	1168
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.9	21.8	23.0	26.3	23.8	8.4
Incr Delay (d2), s/veh	5.7	3.1	0.3	23.3	5.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	7.9	6.6	2.5	7.7	7.2	3.4
Lane Grp Delay (d), s/veh	27.6	24.9	23.3	49.6	29.1	8.6
Lane Grp LOS	C	C	C	D	C	A
Approach Vol, veh/h	1275		658			1223
Approach Delay, s/veh	25.9		36.2			22.4
Approach LOS	C		D			C

Timer						
Assigned Phs			2		1	6
Phs Duration (G+Y+Rc), s			19.9		23.8	43.7
Change Period (Y+Rc), s			4.0		4.0	4.0
Max Green Setting (Gmax), s			16.0		24.0	44.0
Max Q Clear Time (g_c+I1), s			15.8		17.9	10.2
Green Ext Time (p_c), s			0.1		1.9	6.8

Intersection Summary	
HCM 2010 Ctrl Delay	26.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	30	1025	1145	60	55	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	0.95		1.00	
Frt	1.00	1.00	0.99		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3539	3513		1722	
Flt Permitted	0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3539	3513		1722	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1114	1245	65	60	30
RTOR Reduction (vph)	0	0	4	0	25	0
Lane Group Flow (vph)	33	1114	1306	0	65	0
Turn Type	Prot	NA	NA		NA	
Protected Phases	7	4	8		6	
Permitted Phases						
Actuated Green, G (s)	1.6	45.1	39.5		6.2	
Effective Green, g (s)	1.6	45.1	39.5		6.2	
Actuated g/C Ratio	0.03	0.76	0.67		0.10	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	47	2691	2340		180	
v/s Ratio Prot	0.02	c0.31	c0.37		c0.04	
v/s Ratio Perm						
v/c Ratio	0.70	0.41	0.56		0.36	
Uniform Delay, d1	28.6	2.5	5.3		24.7	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	38.0	0.1	0.3		1.2	
Delay (s)	66.6	2.6	5.6		25.9	
Level of Service	E	A	A		C	
Approach Delay (s)		4.4	5.6		25.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	5.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	59.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	60	1020	1150	690	637	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1770	3539	3539	1583	3413	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1770	3539	3539	1583	3413	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	1109	1250	750	692	60
RTOR Reduction (vph)	0	0	0	361	8	0
Lane Group Flow (vph)	65	1109	1250	389	744	0
Turn Type	Prot	NA	NA	Perm	NA	
Protected Phases	7	4	8		6	
Permitted Phases				8		
Actuated Green, G (s)	3.7	45.9	38.2	38.2	19.8	
Effective Green, g (s)	3.7	45.9	38.2	38.2	19.8	
Actuated g/C Ratio	0.05	0.62	0.52	0.52	0.27	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	88	2204	1834	820	916	
v/s Ratio Prot	c0.04	0.31	c0.35		c0.22	
v/s Ratio Perm				0.25		
v/c Ratio	0.74	0.50	0.68	0.47	0.81	
Uniform Delay, d1	34.5	7.6	13.2	11.3	25.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	27.3	0.2	1.1	0.4	5.5	
Delay (s)	61.8	7.8	14.3	11.8	30.8	
Level of Service	E	A	B	B	C	
Approach Delay (s)		10.8	13.3		30.8	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.0%	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)	140	1134	383	620	1364	574	375	480	645	682	590	100
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	184.5	184.5	184.5	184.5	186.3	184.5	186.3	184.5	186.3	186.3	186.3
Lanes	2	3	1	2	3	1	2	2	2	2	2	1
Cap, veh/h	207	1441	408	683	2217	634	475	592	1126	758	893	380
Arrive On Green	0.06	0.26	0.26	0.40	0.80	0.80	0.14	0.16	0.16	0.22	0.24	0.24
Sat Flow, veh/h	3442	5534	1568	3408	5534	1583	3408	3725	3136	3442	3725	1583
Grp Volume(v), veh/h	152	1233	416	674	1483	624	408	522	701	741	641	109
Grp Sat Flow(s),veh/h/ln	1721	1845	1568	1704	1845	1583	1704	1863	1568	1721	1863	1583
Q Serve(g_s), s	4.3	21.2	18.3	19.6	11.5	37.0	11.7	13.7	7.5	21.4	15.8	5.6
Cycle Q Clear(g_c), s	4.3	21.2	18.3	19.6	11.5	37.0	11.7	13.7	7.5	21.4	15.8	5.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	207	1441	408	683	2217	634	475	592	1126	758	893	380
V/C Ratio(X)	0.74	0.86	1.02	0.99	0.67	0.98	0.86	0.88	0.62	0.98	0.72	0.29
Avail Cap(c_a), veh/h	207	1441	408	683	2217	634	512	597	1131	758	893	380
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.74	0.74	0.74	0.55	0.55	0.55	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.1	35.1	18.3	29.8	7.1	9.6	42.0	41.1	10.2	38.7	34.9	31.0
Incr Delay (d2), s/veh	9.6	5.1	43.1	22.3	0.9	22.8	13.1	14.4	1.1	27.0	2.8	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	2.2	10.5	11.7	9.2	2.8	8.5	5.9	7.6	3.0	12.1	7.7	2.3
Lane Grp Delay (d), s/veh	55.8	40.2	61.4	52.2	8.0	32.4	55.1	55.5	11.2	65.7	37.6	31.4
Lane Grp LOS	E	D	F	D	A	C	E	E	B	E	D	C
Approach Vol, veh/h		1801			2781			1631			1491	
Approach Delay, s/veh		46.4			24.2			36.4			51.1	
Approach LOS		D			C			D			D	

Timer												
Assigned Phs	7	4		3	8		5	2		1	6	
Phs Duration (G+Y+Rc), s	10.0	30.0		24.0	44.0		17.9	19.9		26.0	27.9	
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s	6.0	26.0		20.0	40.0		15.0	16.0		22.0	23.0	
Max Q Clear Time (g_c+I1), s	6.3	23.2		21.6	39.0		13.7	15.7		23.4	17.8	
Green Ext Time (p_c), s	0.0	2.2		0.0	1.0		0.2	0.2		0.0	4.1	

Intersection Summary	
HCM 2010 Ctrl Delay	37.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	80	2191	190	655	2203	70	280	0	475	110	0	75
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	190.0	190.0	186.3	190.0
Lanes	2	3	1	2	3	1	2	1	0	0	1	0
Cap, veh/h	373	2562	726	650	3012	853	693	0	319	203	0	138
Arrive On Green	0.14	0.61	0.61	0.25	0.72	0.72	0.20	0.00	0.20	0.20	0.00	0.20
Sat Flow, veh/h	3442	5588	1583	3442	5588	1583	3442	0	1583	1008	0	684
Grp Volume(v), veh/h	83	2282	198	682	2295	73	292	0	495	193	0	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1721	1863	1583	1721	0	1583	1692	0	0
Q Serve(g_s), s	1.7	27.7	4.6	15.0	20.4	1.1	5.9	0.0	16.0	8.2	0.0	0.0
Cycle Q Clear(g_c), s	1.7	27.7	4.6	15.0	20.4	1.1	5.9	0.0	16.0	8.2	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	0.60		0.40
Lane Grp Cap(c), veh/h	373	2562	726	650	3012	853	693	0	319	341	0	0
V/C Ratio(X)	0.22	0.89	0.27	1.05	0.76	0.09	0.42	0.00	1.55	0.57	0.00	0.00
Avail Cap(c_a), veh/h	373	2604	738	650	3378	957	693	0	319	341	0	0
HCM Platoon Ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.36	0.36	0.36	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	31.0	13.8	9.3	29.7	8.1	5.3	27.7	0.0	31.7	28.6	0.0	0.0
Incr Delay (d2), s/veh	0.1	2.0	0.3	48.8	1.9	0.2	0.4	0.0	263.2	2.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.7	10.4	1.6	10.4	6.8	0.4	2.6	0.0	29.6	3.6	0.0	0.0
Lane Grp Delay (d), s/veh	31.1	15.8	9.6	78.6	9.9	5.5	28.1	0.0	294.9	30.8	0.0	0.0
Lane Grp LOS	C	B	A	F	A	A	C		F	C		
Approach Vol, veh/h		2563			3050			787			193	
Approach Delay, s/veh		15.8			25.2			195.9			30.8	
Approach LOS		B			C			F			C	

Timer												
Assigned Phs	7	4		3	8			2			6	
Phs Duration (G+Y+Rc), s	12.6	40.4		19.0	46.8			20.0			20.0	
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0			4.0			4.0	
Max Green Setting (Gmax), s	4.0	37.0		15.0	48.0			16.0			16.0	
Max Q Clear Time (g_c+I1), s	3.7	29.7		17.0	22.4			18.0			10.2	
Green Ext Time (p_c), s	0.1	6.7		0.0	20.4			0.0			2.9	

Intersection Summary	
HCM 2010 Ctrl Delay	42.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	2756	20	0	2908	90	0	0	20	0	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	2932	21	0	3094	96	0	0	21	0	0	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		485			250							
pX, platoon unblocked	0.70			0.55			0.70	0.70	0.55	0.70	0.70	0.70
vC, conflicting volume	3189			2953			3984	6121	1466	4629	6095	1079
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2636			2915			1864	4910	226	2783	4872	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
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 %	100			100			100	100	95	100	100	97
cM capacity (veh/h)	111			68			31	0	430	6	0	762

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	1466	1466	21	1237	1237	714	21	21
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	21	0	0	96	21	21
cSH	1700	1700	1700	1700	1700	1700	430	762
Volume to Capacity	0.86	0.86	0.01	0.73	0.73	0.42	0.05	0.03
Queue Length 95th (ft)	0	0	0	0	0	0	4	2
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	13.8	9.9
Lane LOS							B	A
Approach Delay (s)	0.0			0.0			13.8	9.9
Approach LOS							B	A

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	732	0	228	0	0	0	235	125	0	0	90	1029
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95			0.95	
Frt	1.00	1.00	0.85				1.00	1.00			0.86	
Flt Protected	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)	1649	1649	1553				1736	3471			2992	
Flt Permitted	0.95	0.95	1.00				0.95	1.00			1.00	
Satd. Flow (perm)	1649	1649	1553				1736	3471			2992	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	796	0	248	0	0	0	255	136	0	0	98	1118
RTOR Reduction (vph)	0	0	183	0	0	0	0	0	0	0	700	0
Lane Group Flow (vph)	398	398	65	0	0	0	255	136	0	0	516	0
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Turn Type	Split	NA	Perm	Split			Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)	26.3	26.3	26.3				16.5	41.0			20.5	
Effective Green, g (s)	26.3	26.3	26.3				16.5	41.0			20.5	
Actuated g/C Ratio	0.26	0.26	0.26				0.16	0.41			0.20	
Clearance Time (s)	4.0	4.0	4.0				4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0	3.0				3.0	3.0			3.0	
Lane Grp Cap (vph)	433	433	408				286	1423			613	
v/s Ratio Prot	c0.24	0.24					c0.15	0.04			c0.17	
v/s Ratio Perm			0.04									
v/c Ratio	0.92	0.92	0.16				0.89	0.10			1.10dr	
Uniform Delay, d1	35.8	35.8	28.4				40.9	18.1			38.2	
Progression Factor	0.39	0.39	0.39				1.00	1.00			1.00	
Incremental Delay, d2	23.8	23.8	0.2				27.3	0.0			10.2	
Delay (s)	37.9	37.9	11.2				68.2	18.1			48.4	
Level of Service	D	D	B				E	B			D	
Approach Delay (s)		31.6			0.0			50.8			48.4	
Approach LOS		C			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	42.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Sim-Traffic Operation & Queuing Reports

- Existing Conditions
- Existing + Project Conditions

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	2.0	0.0	1.3	0.9
Total Delay (hr)	0.1	0.1	0.0	0.2
Total Del/Veh (s)	3.6	4.9	1.7	3.8
Vehicles Entered	52	83	37	172
Vehicles Exited	52	83	38	173
Hourly Exit Rate	52	83	38	173
Input Volume	54	78	36	168
% of Volume	96	106	106	103

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.1
Total Delay (hr)	0.1	0.7	0.1	0.0	1.0
Total Del/Veh (s)	9.0	11.7	4.9	5.0	9.1
Vehicles Entered	57	201	100	20	378
Vehicles Exited	56	201	101	20	378
Hourly Exit Rate	56	201	101	20	378
Input Volume	55	197	101	17	370
% of Volume	102	102	100	118	102

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	0.1	0.1	0.0	0.1	0.3
Total Del/Veh (s)	1.7	1.9	4.5	6.0	2.3
Vehicles Entered	138	265	13	52	468
Vehicles Exited	138	265	13	52	468
Hourly Exit Rate	138	265	13	52	468
Input Volume	137	259	14	52	462
% of Volume	101	102	93	100	101

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.1	0.1
Denied Del/Veh (s)	0.0	0.0	2.6	0.8
Total Delay (hr)	0.5	1.0	0.2	1.7
Total Del/Veh (s)	11.0	15.3	3.8	10.7
Vehicles Entered	175	239	172	586
Vehicles Exited	175	239	172	586
Hourly Exit Rate	175	239	172	586
Input Volume	176	237	166	579
% of Volume	99	101	104	101

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	0.0	3.3	1.3
Total Delay (hr)	0.8	0.9	0.4	2.1
Total Del/Veh (s)	14.9	13.7	5.4	10.9
Vehicles Entered	195	229	266	690
Vehicles Exited	195	231	266	692
Hourly Exit Rate	195	231	266	692
Input Volume	195	215	274	684
% of Volume	100	107	97	101

9: Lexington & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.2	0.2	0.1
Total Delay (hr)	0.5	0.0	0.1	0.3	1.0
Total Del/Veh (s)	6.1	1.2	6.0	4.9	5.6
Vehicles Entered	288	1	86	251	626
Vehicles Exited	290	1	86	251	628
Hourly Exit Rate	290	1	86	251	628
Input Volume	280	1	85	239	605
% of Volume	104	100	101	105	104

Total Network Performance

Denied Delay (hr)	0.4
Denied Del/Veh (s)	1.5
Total Delay (hr)	6.6
Total Del/Veh (s)	21.8
Vehicles Entered	1073
Vehicles Exited	1079
Hourly Exit Rate	1079
Input Volume	3912
% of Volume	28

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	R	L	T	L	R	R
Maximum Queue (ft)	51	54	44	43	29	46	20
Average Queue (ft)	7	10	5	5	4	8	1
95th Queue (ft)	31	36	26	25	19	30	8
Link Distance (ft)	784		510	510		535	535
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		150			200		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	R
Maximum Queue (ft)	34	50	43	12	28	132	29	64	9	35	77	20
Average Queue (ft)	7	13	6	1	2	52	2	10	0	5	33	1
95th Queue (ft)	26	40	29	8	13	100	15	35	4	23	62	9
Link Distance (ft)		510	510	510			370	370	370	234	234	234
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Woollomes & HD West

Movement	SB
Directions Served	LTR
Maximum Queue (ft)	32
Average Queue (ft)	7
95th Queue (ft)	25
Link Distance (ft)	244
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HD East & Woollomes

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	30	30	41	72
Average Queue (ft)	2	2	9	29
95th Queue (ft)	15	13	29	55
Link Distance (ft)			267	229
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	50	50		
Storage Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	113	52	119	117	73	78
Average Queue (ft)	41	9	50	47	19	28
95th Queue (ft)	85	32	94	95	51	58
Link Distance (ft)	263	263		465	482	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			1	0		
Queuing Penalty (veh)			1	0		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	119	103	147	56	51	90
Average Queue (ft)	52	36	64	19	9	37
95th Queue (ft)	93	80	114	45	32	71
Link Distance (ft)		465	594		819	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Lexington & Woollomes

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	LTR	LT	TR
Maximum Queue (ft)	113	17	86	55	84
Average Queue (ft)	57	1	36	31	46
95th Queue (ft)	91	7	64	54	74
Link Distance (ft)	594	224	406	484	484
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Denied Del/Veh (s)	2.2	0.0	2.1	1.2
Total Delay (hr)	0.1	0.2	0.1	0.3
Total Del/Veh (s)	4.2	4.8	3.1	4.2
Vehicles Entered	94	125	74	293
Vehicles Exited	94	126	74	294
Hourly Exit Rate	94	126	74	294
Input Volume	98	121	76	295
% of Volume	96	104	97	100

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.1
Total Delay (hr)	0.3	1.0	0.3	0.1	1.7
Total Del/Veh (s)	12.2	11.3	5.4	7.9	9.2
Vehicles Entered	84	321	232	37	674
Vehicles Exited	85	322	232	36	675
Hourly Exit Rate	85	322	232	36	675
Input Volume	87	322	231	38	678
% of Volume	98	100	100	95	100

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	0.1	0.2	0.0	0.2	0.5
Total Del/Veh (s)	1.6	1.8	4.5	8.7	2.4
Vehicles Entered	288	374	20	67	749
Vehicles Exited	287	375	21	67	750
Hourly Exit Rate	287	375	21	67	750
Input Volume	290	385	18	68	761
% of Volume	99	97	117	99	99

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	0.0	3.2	0.6
Total Delay (hr)	1.1	1.5	0.2	2.9
Total Del/Veh (s)	11.5	14.9	4.3	11.5
Vehicles Entered	348	369	178	895
Vehicles Exited	347	368	179	894
Hourly Exit Rate	347	368	179	894
Input Volume	351	380	179	910
% of Volume	99	97	100	98

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.3	0.3
Denied Del/Veh (s)	0.0	0.0	3.1	1.0
Total Delay (hr)	1.4	1.5	0.8	3.7
Total Del/Veh (s)	16.6	15.0	9.2	13.6
Vehicles Entered	301	353	306	960
Vehicles Exited	301	354	306	961
Hourly Exit Rate	301	354	306	961
Input Volume	302	360	318	980
% of Volume	100	98	96	98

9: Lexington & Woollomes Performance by approach

Approach	EB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.2	0.2	0.1
Total Delay (hr)	0.7	0.5	0.4	1.5
Total Del/Veh (s)	7.7	7.7	5.2	6.9
Vehicles Entered	317	213	264	794
Vehicles Exited	317	213	263	793
Hourly Exit Rate	317	213	263	793
Input Volume	322	219	270	811
% of Volume	98	97	97	98

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	1.3
Total Delay (hr)	11.2
Total Del/Veh (s)	25.9
Vehicles Entered	1522
Vehicles Exited	1529
Hourly Exit Rate	1529
Input Volume	5952
% of Volume	26

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	R	L	T	L	R	R
Maximum Queue (ft)	54	39	34	66	44	37	24
Average Queue (ft)	14	20	6	8	13	11	1
95th Queue (ft)	42	41	26	37	34	32	9
Link Distance (ft)	1281		510	510		535	535
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		150			200		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	R
Maximum Queue (ft)	39	57	35	12	28	164	26	67	12	32	114	20
Average Queue (ft)	10	22	7	1	2	71	3	16	1	7	47	2
95th Queue (ft)	34	50	29	10	15	131	16	45	5	27	82	10
Link Distance (ft)		510	510	510			369	369	369	233	233	233
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Woollomes & HD West

Movement	SB
Directions Served	LTR
Maximum Queue (ft)	44
Average Queue (ft)	14
95th Queue (ft)	36
Link Distance (ft)	244
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HD East & Woollomes

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	24	31	8	27	83
Average Queue (ft)	3	5	0	10	30
95th Queue (ft)	17	23	4	27	59
Link Distance (ft)			264	267	229
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	50	50			
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	163	38	143	128	53	76
Average Queue (ft)	71	10	67	54	14	32
95th Queue (ft)	127	26	114	102	38	56
Link Distance (ft)	264	264		465	481	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			2	1		
Queuing Penalty (veh)			5	1		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	146	143	197	112	67	65
Average Queue (ft)	70	45	90	38	20	31
95th Queue (ft)	120	101	162	82	51	57
Link Distance (ft)		465	596		793	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Lexington & Woollomes

Movement	EB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR
Maximum Queue (ft)	127	102	56	78
Average Queue (ft)	55	50	28	43
95th Queue (ft)	93	81	48	68
Link Distance (ft)	596	406	484	484
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 6

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.1	0.0	0.1	0.2
Denied Del/Veh (s)	2.7	0.0	2.4	1.8
Total Delay (hr)	0.1	0.1	0.1	0.4
Total Del/Veh (s)	3.7	5.4	3.5	4.1
Vehicles Entered	125	98	139	362
Vehicles Exited	125	97	138	360
Hourly Exit Rate	125	97	138	360
Input Volume	119	98	132	349
% of Volume	105	99	105	103

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.1
Total Delay (hr)	0.5	1.2	0.5	0.1	2.3
Total Del/Veh (s)	17.8	13.0	6.2	7.9	10.9
Vehicles Entered	104	333	278	38	753
Vehicles Exited	103	333	279	38	753
Hourly Exit Rate	103	333	279	38	753
Input Volume	101	339	270	40	750
% of Volume	102	98	103	95	100

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.2	0.0
Total Delay (hr)	0.2	0.2	0.0	0.2	0.6
Total Del/Veh (s)	1.8	1.5	4.2	9.8	2.6
Vehicles Entered	327	382	14	91	814
Vehicles Exited	327	383	14	91	815
Hourly Exit Rate	327	383	14	91	815
Input Volume	319	388	13	88	808
% of Volume	103	99	108	103	101

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	0.0	3.5	0.9
Total Delay (hr)	1.3	1.0	0.2	2.5
Total Del/Veh (s)	11.3	15.2	3.4	10.3
Vehicles Entered	405	239	226	870
Vehicles Exited	404	239	226	869
Hourly Exit Rate	404	239	226	869
Input Volume	392	245	232	869
% of Volume	103	98	97	100

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	0.0	3.4	0.8
Total Delay (hr)	1.6	0.8	0.4	2.8
Total Del/Veh (s)	15.8	15.0	9.0	14.0
Vehicles Entered	351	184	168	703
Vehicles Exited	350	185	167	702
Hourly Exit Rate	350	185	167	702
Input Volume	340	190	177	707
% of Volume	103	97	94	99

9: Lexington & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1
Total Delay (hr)	0.5	0.0	0.1	0.2	0.8
Total Del/Veh (s)	6.9	10.1	6.1	3.7	5.6
Vehicles Entered	255	1	66	176	498
Vehicles Exited	257	1	66	177	501
Hourly Exit Rate	257	1	66	177	501
Input Volume	255	1	69	177	502
% of Volume	101	100	96	100	100

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	1.6
Total Delay (hr)	9.7
Total Del/Veh (s)	25.4
Vehicles Entered	1350
Vehicles Exited	1355
Hourly Exit Rate	1355
Input Volume	5302
% of Volume	26

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	NB	NB	NB
Directions Served	T	R	L	T	L	R	R
Maximum Queue (ft)	36	48	39	50	60	53	23
Average Queue (ft)	14	23	9	9	22	16	1
95th Queue (ft)	40	42	32	34	45	39	9
Link Distance (ft)	1281		514	514		535	535
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		150			200		
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	TR	R	LTR
Maximum Queue (ft)	58	84	58	27	162	31	47	11	49	131	28	55
Average Queue (ft)	19	28	8	4	83	3	11	1	9	54	1	14
95th Queue (ft)	45	65	34	20	141	16	34	6	34	97	20	38
Link Distance (ft)		514	514			368	368	368	233	233	233	244
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250			250	300							
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 6: HD East & Woollomes

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	31	17	4	31	86
Average Queue (ft)	3	1	0	8	38
95th Queue (ft)	18	12	3	25	70
Link Distance (ft)			260	267	229
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	50	50			
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	188	50	79	106	36	67
Average Queue (ft)	75	11	35	51	6	34
95th Queue (ft)	132	30	72	97	23	56
Link Distance (ft)	260	260		465	481	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			0	0		
Queuing Penalty (veh)			1	0		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	172	115	128	82	48	52
Average Queue (ft)	75	52	53	28	7	19
95th Queue (ft)	129	99	95	61	28	43
Link Distance (ft)		465	597		815	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Lexington & Woollomes

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	LTR	LT	TR
Maximum Queue (ft)	107	18	67	42	69
Average Queue (ft)	52	1	30	22	36
95th Queue (ft)	87	11	52	45	55
Link Distance (ft)	597	224	406	484	484
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.1
Denied Del/Veh (s)	0.9	0.0	1.5	3.8	0.8
Total Delay (hr)	0.2	0.3	0.1	0.1	0.7
Total Del/Veh (s)	6.8	4.5	4.6	7.4	5.4
Vehicles Entered	122	238	43	41	444
Vehicles Exited	123	238	42	41	444
Hourly Exit Rate	123	238	42	41	444
Input Volume	119	242	42	40	443
% of Volume	103	98	100	102	100

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	0.5	0.9	0.2	0.0	1.6
Total Del/Veh (s)	10.5	9.1	5.5	5.9	8.8
Vehicles Entered	160	358	101	18	637
Vehicles Exited	161	358	100	18	637
Hourly Exit Rate	161	358	100	18	637
Input Volume	156	363	101	17	637
% of Volume	103	99	99	106	100

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	0.2	0.2	0.0	0.1	0.5
Total Del/Veh (s)	2.5	2.0	5.2	7.8	2.6
Vehicles Entered	240	419	16	52	727
Vehicles Exited	240	419	16	52	727
Hourly Exit Rate	240	419	16	52	727
Input Volume	240	428	14	52	734
% of Volume	100	98	114	100	99

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.2	0.2
Denied Del/Veh (s)	0.0	0.0	3.0	0.9
Total Delay (hr)	0.8	1.4	0.3	2.5
Total Del/Veh (s)	10.6	15.5	4.5	10.7
Vehicles Entered	276	316	244	836
Vehicles Exited	275	317	242	834
Hourly Exit Rate	275	317	242	834
Input Volume	279	321	247	847
% of Volume	99	99	98	98

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.3	0.3
Denied Del/Veh (s)	0.0	0.0	3.3	1.3
Total Delay (hr)	1.2	1.0	0.7	2.9
Total Del/Veh (s)	16.8	15.3	7.8	12.8
Vehicles Entered	253	235	324	812
Vehicles Exited	254	235	324	813
Hourly Exit Rate	254	235	324	813
Input Volume	259	241	334	834
% of Volume	98	98	97	97

9: Lexington & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Delay (hr)	0.5	0.0	0.1	0.3	1.0
Total Del/Veh (s)	6.0	1.4	5.6	5.0	5.5
Vehicles Entered	282	1	86	254	623
Vehicles Exited	282	1	86	253	622
Hourly Exit Rate	282	1	86	253	622
Input Volume	288	1	91	257	637
% of Volume	98	100	95	98	98

Total Network Performance

Denied Delay (hr)	0.6
Denied Del/Veh (s)	1.7
Total Delay (hr)	9.5
Total Del/Veh (s)	25.3
Vehicles Entered	1337
Vehicles Exited	1336
Hourly Exit Rate	1336
Input Volume	5452
% of Volume	25

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	T	R	L	TR	R	L	T
Maximum Queue (ft)	61	46	46	61	35	47	46	5	58	21
Average Queue (ft)	25	9	6	13	7	9	9	0	19	1
95th Queue (ft)	53	30	27	42	23	29	32	5	43	9
Link Distance (ft)	370		506	506			535	535		348
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)		150			250	200			200	
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	R
Maximum Queue (ft)	45	86	66	18	21	117	27	100	15	31	85	12
Average Queue (ft)	8	34	18	1	1	55	2	29	1	8	32	1
95th Queue (ft)	31	71	52	11	11	99	16	70	6	28	61	6
Link Distance (ft)		506	506	506			371	371	371	234	234	234
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 5: Woollomes & HD West

Movement	SB
Directions Served	LTR
Maximum Queue (ft)	40
Average Queue (ft)	7
95th Queue (ft)	26
Link Distance (ft)	244
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HD East & Woollomes

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	24	30	4	40	70
Average Queue (ft)	3	3	0	9	29
95th Queue (ft)	16	19	3	29	62
Link Distance (ft)			266	267	229
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	50	50			
Storage Blk Time (%)	0	0			
Queuing Penalty (veh)	0	0			

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	127	55	128	160	67	84
Average Queue (ft)	54	13	53	63	20	40
95th Queue (ft)	104	38	103	125	52	70
Link Distance (ft)	266	266		464	481	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			1	1		
Queuing Penalty (veh)			2	1		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	158	96	174	117	45	73
Average Queue (ft)	74	36	70	42	10	36
95th Queue (ft)	130	77	131	89	32	61
Link Distance (ft)		464	595		1046	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 9: Lexington & Woollomes

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	LTR	LT	TR
Maximum Queue (ft)	101	18	76	58	75
Average Queue (ft)	52	1	36	31	43
95th Queue (ft)	83	7	60	51	71
Link Distance (ft)	595	224	406	484	484
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 4

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.0	0.2	0.4
Denied Del/Veh (s)	0.8	0.0	1.8	3.5	0.9
Total Delay (hr)	1.5	1.5	0.3	1.0	4.3
Total Del/Veh (s)	11.7	8.2	13.5	15.5	10.9
Stop Delay (hr)	0.7	0.5	0.3	0.8	2.3
Stop Del/Veh (s)	5.6	2.8	11.5	12.4	5.8
Vehicles Entered	471	638	91	229	1429
Vehicles Exited	470	638	91	229	1428
Hourly Exit Rate	470	638	91	229	1428
Input Volume	465	649	96	222	1432
% of Volume	101	98	95	103	100

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.0
Total Delay (hr)	3.2	2.8	0.5	0.1	6.7
Total Del/Veh (s)	17.2	11.8	8.4	11.0	13.3
Stop Delay (hr)	1.9	1.8	0.5	0.1	4.2
Stop Del/Veh (s)	9.9	7.7	7.3	9.6	8.5
Vehicles Entered	670	844	232	41	1787
Vehicles Exited	670	846	232	41	1789
Hourly Exit Rate	670	846	232	41	1789
Input Volume	657	845	231	38	1771
% of Volume	102	100	100	108	101

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	1.5	0.1
Total Delay (hr)	1.1	0.6	0.1	2.0	3.8
Total Del/Veh (s)	4.7	2.2	23.8	102.0	7.3
Stop Delay (hr)	0.1	0.1	0.1	2.0	2.3
Stop Del/Veh (s)	0.5	0.3	23.5	101.2	4.4
Vehicles Entered	870	919	18	69	1876
Vehicles Exited	871	919	19	69	1878
Hourly Exit Rate	871	919	19	69	1878
Input Volume	856	919	18	68	1861
% of Volume	102	100	106	101	101

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.4	0.5
Denied Del/Veh (s)	0.2	0.0	3.4	0.8
Total Delay (hr)	4.0	3.2	1.3	8.5
Total Del/Veh (s)	15.2	17.7	10.6	15.0
Stop Delay (hr)	2.6	1.9	1.0	5.4
Stop Del/Veh (s)	9.8	10.3	8.0	9.6
Vehicles Entered	943	641	439	2023
Vehicles Exited	940	643	439	2022
Hourly Exit Rate	940	643	439	2022
Input Volume	930	652	435	2017
% of Volume	101	99	101	100

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.5	0.5
Denied Del/Veh (s)	0.0	0.0	3.2	1.0
Total Delay (hr)	4.8	3.8	3.3	11.9
Total Del/Veh (s)	25.6	31.0	23.1	26.3
Stop Delay (hr)	3.3	2.9	2.8	8.9
Stop Del/Veh (s)	17.5	23.1	19.0	19.5
Vehicles Entered	666	435	513	1614
Vehicles Exited	665	438	512	1615
Hourly Exit Rate	665	438	512	1615
Input Volume	666	437	510	1613
% of Volume	100	100	100	100

9: Lexington & Woollomes Performance by approach

Approach	EB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.3	0.2	0.1
Total Delay (hr)	0.9	0.5	0.5	1.9
Total Del/Veh (s)	8.3	8.2	5.8	7.4
Stop Delay (hr)	0.4	0.3	0.3	1.0
Stop Del/Veh (s)	4.2	4.0	3.1	3.8
Vehicles Entered	368	232	325	925
Vehicles Exited	368	231	325	924
Hourly Exit Rate	368	231	325	924
Input Volume	364	239	328	931
% of Volume	101	97	99	99

Total Network Performance

Denied Delay (hr)	1.4
Denied Del/Veh (s)	1.8
Total Delay (hr)	38.2
Total Del/Veh (s)	49.2
Stop Delay (hr)	24.3
Stop Del/Veh (s)	31.2
Vehicles Entered	2725
Vehicles Exited	2724
Hourly Exit Rate	2724
Input Volume	12276
% of Volume	22

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	T	R	L	TR	R	L	T
Maximum Queue (ft)	178	41	36	157	65	59	56	16	145	46
Average Queue (ft)	90	10	9	68	26	20	23	1	76	9
95th Queue (ft)	152	28	27	135	53	45	48	9	129	31
Link Distance (ft)	771		513	513			535	535		356
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)		150			250	200			200	
Storage Blk Time (%)	1									
Queuing Penalty (veh)	0									

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	R
Maximum Queue (ft)	44	232	168	29	26	188	78	227	17	43	117	16
Average Queue (ft)	12	121	85	2	2	95	10	87	1	7	56	1
95th Queue (ft)	38	198	152	15	14	163	45	177	9	28	97	8
Link Distance (ft)		513	513	513			367	367	367	234	234	234
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)		0										
Queuing Penalty (veh)		0										

Intersection: 5: Woollomes & HD West

Movement	SB
Directions Served	LTR
Maximum Queue (ft)	59
Average Queue (ft)	16
95th Queue (ft)	42
Link Distance (ft)	244
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HD East & Woollomes

Movement	EB	EB	EB	WB	NB	SB
Directions Served	L	T	T	L	LTR	LTR
Maximum Queue (ft)	30	109	4	30	55	172
Average Queue (ft)	7	10	0	6	12	74
95th Queue (ft)	28	62	3	26	37	168
Link Distance (ft)		367	367		267	229
Upstream Blk Time (%)						2
Queuing Penalty (veh)						0
Storage Bay Dist (ft)	50			50		
Storage Blk Time (%)	0	1		0		
Queuing Penalty (veh)	0	0		0		

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	290	108	161	259	63	191
Average Queue (ft)	184	43	83	119	14	89
95th Queue (ft)	287	91	141	208	42	156
Link Distance (ft)	263	263		465	481	
Upstream Blk Time (%)	2					
Queuing Penalty (veh)	9					
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			7	7		
Queuing Penalty (veh)			36	10		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	332	234	332	244	106	76
Average Queue (ft)	216	54	186	143	31	39
95th Queue (ft)	306	152	299	229	74	64
Link Distance (ft)		465	598		938	
Upstream Blk Time (%)		0				
Queuing Penalty (veh)		0				
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)	2			0		
Queuing Penalty (veh)	4			0		

Intersection: 9: Lexington & Woollomes

Movement	EB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR
Maximum Queue (ft)	132	103	56	93
Average Queue (ft)	61	53	27	52
95th Queue (ft)	102	87	49	82
Link Distance (ft)	598	406	484	484
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 60

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.2	0.0	0.1	0.3	0.5
Denied Del/Veh (s)	1.1	0.0	1.9	3.4	1.0
Total Delay (hr)	2.7	2.9	0.8	1.8	8.2
Total Del/Veh (s)	15.9	11.7	17.1	21.8	14.9
Vehicles Entered	618	893	159	288	1958
Vehicles Exited	618	896	159	285	1958
Hourly Exit Rate	618	896	159	285	1958
Input Volume	601	906	162	292	1961
% of Volume	103	99	98	98	100

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.0
Total Delay (hr)	11.6	5.3	0.9	0.2	18.0
Total Del/Veh (s)	48.3	16.9	11.6	13.1	27.9
Vehicles Entered	857	1125	275	42	2299
Vehicles Exited	853	1127	276	42	2298
Hourly Exit Rate	853	1127	276	42	2298
Input Volume	847	1146	270	40	2303
% of Volume	101	98	102	105	100

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	33.4	33.4
Denied Del/Veh (s)	0.0	0.0	0.1	1266.8	50.7
Total Delay (hr)	1.9	0.7	0.1	10.6	13.4
Total Del/Veh (s)	6.3	2.1	39.4	1126.0	20.8
Vehicles Entered	1074	1192	12	26	2304
Vehicles Exited	1074	1191	12	24	2301
Hourly Exit Rate	1074	1191	12	24	2301
Input Volume	1065	1196	13	88	2362
% of Volume	101	100	92	27	97

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.7	0.7
Denied Del/Veh (s)	0.0	0.0	4.1	1.1
Total Delay (hr)	4.6	3.2	5.9	13.7
Total Del/Veh (s)	15.2	17.4	33.8	20.7
Vehicles Entered	1096	664	617	2377
Vehicles Exited	1095	665	619	2379
Hourly Exit Rate	1095	665	619	2379
Input Volume	1138	669	627	2434
% of Volume	96	99	99	98

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.4	0.4
Denied Del/Veh (s)	0.0	0.0	3.4	1.0
Total Delay (hr)	5.3	3.9	3.3	12.6
Total Del/Veh (s)	23.8	44.5	25.8	28.6
Vehicles Entered	789	314	461	1564
Vehicles Exited	789	313	463	1565
Hourly Exit Rate	789	313	463	1565
Input Volume	823	311	473	1607
% of Volume	96	101	98	97

9: Lexington & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Delay (hr)	0.7	0.0	0.2	0.3	1.2
Total Del/Veh (s)	8.0	9.9	6.1	4.6	6.3
Vehicles Entered	295	1	101	268	665
Vehicles Exited	293	1	101	268	663
Hourly Exit Rate	293	1	101	268	663
Input Volume	310	1	99	266	676
% of Volume	95	100	102	101	98

Total Network Performance

Denied Delay (hr)	35.2
Denied Del/Veh (s)	42.4
Total Delay (hr)	68.4
Total Del/Veh (s)	81.5
Vehicles Entered	2920
Vehicles Exited	2913
Hourly Exit Rate	2913
Input Volume	14274
% of Volume	20

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	T	R	L	TR	R	L	T
Maximum Queue (ft)	372	144	47	252	125	96	72	17	199	103
Average Queue (ft)	152	23	15	118	38	34	35	1	99	20
95th Queue (ft)	293	91	38	216	85	73	64	8	170	75
Link Distance (ft)	370		510	510			535	535		384
Upstream Blk Time (%)	0									
Queuing Penalty (veh)	0									
Storage Bay Dist (ft)		150			250	200			200	
Storage Blk Time (%)	7			0					1	
Queuing Penalty (veh)	6			0					0	

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	LTR
Maximum Queue (ft)	300	470	473	241	28	224	220	367	7	52	146	51
Average Queue (ft)	51	283	239	19	4	110	33	180	0	12	70	16
95th Queue (ft)	200	468	438	141	19	184	125	308	3	37	120	38
Link Distance (ft)		510	510	510			370	370	370	233	233	244
Upstream Blk Time (%)		1	0				0	0				
Queuing Penalty (veh)		2	0				0	1				
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)		30		0		0	0					
Queuing Penalty (veh)		8		0		0	0					

Intersection: 6: HD East & Woollomes

Movement	EB	EB	WB	WB	WB	NB	SB
Directions Served	L	T	L	T	TR	LTR	LTR
Maximum Queue (ft)	45	248	30	19	42	44	254
Average Queue (ft)	8	32	3	1	2	8	235
95th Queue (ft)	32	138	16	11	16	27	256
Link Distance (ft)		370		262	262	268	229
Upstream Blk Time (%)							97
Queuing Penalty (veh)							0
Storage Bay Dist (ft)	50		50				
Storage Blk Time (%)	0	3	0	0			
Queuing Penalty (veh)	1	0	0	0			

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LT	R
Maximum Queue (ft)	279	119	149	320	388	384
Average Queue (ft)	220	45	48	124	94	241
95th Queue (ft)	315	94	99	294	395	421
Link Distance (ft)	262	262		465	481	
Upstream Blk Time (%)	4				5	
Queuing Penalty (veh)	25				0	
Storage Bay Dist (ft)			100			300
Storage Blk Time (%)			2	12		16
Queuing Penalty (veh)			9	7		4

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	T	TR	L	T	R
Maximum Queue (ft)	354	447	323	323	62	60
Average Queue (ft)	244	118	173	165	15	25
95th Queue (ft)	387	331	281	271	45	52
Link Distance (ft)		465	597		733	
Upstream Blk Time (%)		0				
Queuing Penalty (veh)		1				
Storage Bay Dist (ft)	275			300		550
Storage Blk Time (%)	9	0		0		
Queuing Penalty (veh)	21	3		1		

Intersection: 9: Lexington & Woollomes

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	LTR	LT	TR
Maximum Queue (ft)	114	18	73	52	83
Average Queue (ft)	58	1	36	21	46
95th Queue (ft)	92	11	57	47	71
Link Distance (ft)	597	224	406	484	484
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 89

Sim-Traffic Operation & Queuing Reports

- Existing + Project Conditions Mitigations

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.0	0.2	0.4
Denied Del/Veh (s)	0.8	0.0	1.7	3.5	0.9
Total Delay (hr)	1.5	1.5	0.4	0.9	4.3
Total Del/Veh (s)	12.1	8.4	13.6	15.1	11.0
Stop Delay (hr)	0.8	0.5	0.3	0.7	2.3
Stop Del/Veh (s)	6.0	2.7	11.4	12.1	5.8
Vehicles Entered	456	633	95	217	1401
Vehicles Exited	457	631	95	215	1398
Hourly Exit Rate	457	631	95	215	1398
Input Volume	465	649	96	222	1432
% of Volume	98	97	99	97	98

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.0
Total Delay (hr)	3.4	3.0	0.5	0.4	7.3
Total Del/Veh (s)	18.6	13.0	8.2	15.6	14.5
Stop Delay (hr)	2.0	2.0	0.5	0.4	4.8
Stop Del/Veh (s)	11.0	8.5	7.2	13.7	9.5
Vehicles Entered	646	840	228	93	1807
Vehicles Exited	644	839	229	93	1805
Hourly Exit Rate	644	839	229	93	1805
Input Volume	657	845	231	93	1826
% of Volume	98	99	99	100	99

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	1.1	0.6	0.0	0.0	1.8
Total Del/Veh (s)	4.6	2.3	10.8	5.7	3.5
Stop Delay (hr)	0.1	0.1	0.0	0.0	0.3
Stop Del/Veh (s)	0.5	0.4	10.8	5.7	0.6
Vehicles Entered	898	922	16	13	1849
Vehicles Exited	897	920	16	13	1846
Hourly Exit Rate	897	920	16	13	1846
Input Volume	911	919	18	13	1861
% of Volume	98	100	89	100	99

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.3	0.3
Denied Del/Veh (s)	0.1	0.0	2.3	0.6
Total Delay (hr)	3.7	3.1	1.0	7.8
Total Del/Veh (s)	14.4	17.1	8.1	13.9
Stop Delay (hr)	2.3	1.8	0.8	4.9
Stop Del/Veh (s)	9.1	10.1	6.3	8.8
Vehicles Entered	918	651	436	2005
Vehicles Exited	919	651	438	2008
Hourly Exit Rate	919	651	438	2008
Input Volume	930	652	435	2017
% of Volume	99	100	101	100

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.5	0.5
Denied Del/Veh (s)	0.0	0.0	3.2	1.0
Total Delay (hr)	4.9	4.1	2.8	11.7
Total Del/Veh (s)	26.4	33.1	19.4	26.0
Stop Delay (hr)	3.3	3.0	2.2	8.6
Stop Del/Veh (s)	18.0	24.7	15.6	19.1
Vehicles Entered	656	433	509	1598
Vehicles Exited	654	436	510	1600
Hourly Exit Rate	654	436	510	1600
Input Volume	666	437	510	1613
% of Volume	98	100	100	99

9: Lexington & Woollomes Performance by approach

Approach	EB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.3	0.2	0.1
Total Delay (hr)	1.0	0.5	0.5	2.1
Total Del/Veh (s)	10.0	8.1	6.0	8.1
Stop Delay (hr)	0.5	0.3	0.3	1.0
Stop Del/Veh (s)	4.6	3.9	3.2	3.9
Vehicles Entered	368	237	328	933
Vehicles Exited	368	237	330	935
Hourly Exit Rate	368	237	330	935
Input Volume	364	239	328	931
% of Volume	101	99	101	100

Total Network Performance

Denied Delay (hr)	1.2
Denied Del/Veh (s)	1.6
Total Delay (hr)	36.1
Total Del/Veh (s)	46.9
Stop Delay (hr)	22.1
Stop Del/Veh (s)	28.6
Vehicles Entered	2694
Vehicles Exited	2699
Hourly Exit Rate	2699
Input Volume	12331
% of Volume	22

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	T	R	L	TR	R	L	T
Maximum Queue (ft)	226	115	29	221	58	72	74	20	155	43
Average Queue (ft)	92	14	7	74	22	21	25	1	70	11
95th Queue (ft)	174	57	22	166	45	50	53	7	123	34
Link Distance (ft)	771		513	513			535	535		356
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)		150			250	200			200	
Storage Blk Time (%)	2			0						
Queuing Penalty (veh)	1			0						

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	R
Maximum Queue (ft)	41	240	194	59	22	183	97	226	15	42	131	26
Average Queue (ft)	11	123	87	4	2	95	14	97	1	6	54	1
95th Queue (ft)	36	200	152	31	14	157	56	180	8	26	101	18
Link Distance (ft)		513	513	513			367	367	367	234	234	234
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)		0										
Queuing Penalty (veh)		0										

Intersection: 5: Woollomes & HD West

Movement	SB
Directions Served	LTR
Maximum Queue (ft)	89
Average Queue (ft)	36
95th Queue (ft)	72
Link Distance (ft)	244
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 6: HD East & Woollomes

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	T	L	TR	LTR	R
Maximum Queue (ft)	30	124	37	18	25	27
Average Queue (ft)	5	9	11	1	9	9
95th Queue (ft)	24	62	34	9	26	30
Link Distance (ft)		367		263	267	229
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	50		50			
Storage Blk Time (%)	0	1	0			
Queuing Penalty (veh)	0	0	0			

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LTR	R
Maximum Queue (ft)	284	136	169	208	132	132
Average Queue (ft)	170	46	81	107	49	60
95th Queue (ft)	282	99	147	196	96	102
Link Distance (ft)	263	263		465	481	
Upstream Blk Time (%)	2					
Queuing Penalty (veh)	8					
Storage Bay Dist (ft)			150			300
Storage Blk Time (%)			2	2		
Queuing Penalty (veh)			8	3		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	LT	TR	L	T	R
Maximum Queue (ft)	225	258	372	224	74	86
Average Queue (ft)	111	165	183	128	28	39
95th Queue (ft)	183	237	320	203	60	69
Link Distance (ft)		465	598		938	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	225			300		550
Storage Blk Time (%)	0	1		0		
Queuing Penalty (veh)	0	2		0		

Intersection: 9: Lexington & Woollomes

Movement	EB	NB	SB	SB
Directions Served	LTR	LTR	LT	TR
Maximum Queue (ft)	137	104	62	92
Average Queue (ft)	71	53	29	51
95th Queue (ft)	115	84	51	82
Link Distance (ft)	598	406	484	484
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 22

4: Dover & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.2	0.0	0.1	0.3	0.6
Denied Del/Veh (s)	1.5	0.0	1.9	3.4	1.1
Total Delay (hr)	2.6	2.9	0.9	1.7	8.0
Total Del/Veh (s)	15.6	11.6	18.7	21.0	14.8
Vehicles Entered	595	889	165	284	1933
Vehicles Exited	595	893	165	283	1936
Hourly Exit Rate	595	893	165	283	1936
Input Volume	601	906	162	292	1961
% of Volume	99	99	102	97	99

5: Woollomes & HD West Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.3	0.2	0.0
Total Delay (hr)	10.5	6.8	0.9	0.6	18.8
Total Del/Veh (s)	44.8	21.4	12.5	21.2	28.8
Vehicles Entered	831	1136	262	104	2333
Vehicles Exited	829	1133	262	103	2327
Hourly Exit Rate	829	1133	262	103	2327
Input Volume	847	1146	270	110	2373
% of Volume	98	99	97	94	98

6: HD East & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Delay (hr)	1.9	1.1	0.0	0.1	3.1
Total Del/Veh (s)	6.2	3.3	15.7	16.1	4.9
Vehicles Entered	1103	1185	11	19	2318
Vehicles Exited	1104	1185	11	19	2319
Hourly Exit Rate	1104	1185	11	19	2319
Input Volume	1135	1196	13	18	2362
% of Volume	97	99	85	106	98

7: SR 99 SB Ramps & Woollomes Performance by approach

Approach	EB	WB	SB	All
Denied Delay (hr)	0.0	0.0	0.4	0.4
Denied Del/Veh (s)	0.0	0.0	2.6	0.7
Total Delay (hr)	4.2	2.6	1.9	8.7
Total Del/Veh (s)	13.7	13.9	11.0	13.0
Vehicles Entered	1105	660	621	2386
Vehicles Exited	1104	659	619	2382
Hourly Exit Rate	1104	659	619	2382
Input Volume	1137	669	627	2433
% of Volume	97	99	99	98

8: SR 99 NB Ramps & Woollomes Performance by approach

Approach	EB	WB	NB	All
Denied Delay (hr)	0.0	0.0	0.4	0.4
Denied Del/Veh (s)	0.0	0.0	3.4	1.0
Total Delay (hr)	5.5	2.2	2.7	10.4
Total Del/Veh (s)	24.8	24.9	21.3	23.8
Vehicles Entered	796	311	457	1564
Vehicles Exited	794	310	462	1566
Hourly Exit Rate	794	310	462	1566
Input Volume	823	311	473	1607
% of Volume	96	100	98	97

9: Lexington & Woollomes Performance by approach

Approach	EB	WB	NB	SB	All
Denied Delay (hr)	0.0	0.0	0.0	0.0	0.0
Denied Del/Veh (s)	0.0		0.2	0.2	0.1
Total Delay (hr)	0.8	0.0	0.2	0.3	1.3
Total Del/Veh (s)	9.1		6.0	4.5	6.8
Vehicles Entered	302	0	100	266	668
Vehicles Exited	302	0	100	265	667
Hourly Exit Rate	302	0	100	265	667
Input Volume	310	1	99	266	676
% of Volume	97	0	101	100	99

Total Network Performance

Denied Delay (hr)	1.5
Denied Del/Veh (s)	1.9
Total Delay (hr)	51.5
Total Del/Veh (s)	61.5
Vehicles Entered	2930
Vehicles Exited	2924
Hourly Exit Rate	2924
Input Volume	14343
% of Volume	20

Intersection: 4: Dover & Woollomes

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	T	R	L	T	R	L	TR	R	L	T
Maximum Queue (ft)	339	172	47	248	136	88	75	30	189	53
Average Queue (ft)	144	26	12	113	40	37	37	2	98	15
95th Queue (ft)	282	104	35	208	91	75	66	14	164	40
Link Distance (ft)	370		510	510			535	535		384
Upstream Blk Time (%)	1									
Queuing Penalty (veh)	0									
Storage Bay Dist (ft)		150			250	200			200	
Storage Blk Time (%)	7			0					0	
Queuing Penalty (veh)	5			0					0	

Intersection: 5: Woollomes & HD West

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	R	L	T	T	R	L	TR	LTR
Maximum Queue (ft)	300	471	434	273	28	240	310	392	9	40	172	95
Average Queue (ft)	53	247	208	15	3	119	60	213	0	10	75	44
95th Queue (ft)	201	423	396	118	17	197	215	376	3	33	136	87
Link Distance (ft)		510	510	510			370	370	370	233	233	244
Upstream Blk Time (%)		1	0				0	3				
Queuing Penalty (veh)		2	0				1	10				
Storage Bay Dist (ft)	250				250	300						
Storage Blk Time (%)		20		0		0	0					
Queuing Penalty (veh)		5		0		0	1					

Intersection: 6: HD East & Woollomes

Movement	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	L	T	T	L	T	TR	LTR	R
Maximum Queue (ft)	48	221	79	24	128	160	38	49
Average Queue (ft)	7	20	3	3	8	19	7	14
95th Queue (ft)	31	109	56	17	79	108	26	40
Link Distance (ft)		370	370		262	262	268	229
Upstream Blk Time (%)			0		0	0		
Queuing Penalty (veh)			0		0	2		
Storage Bay Dist (ft)	50			50				
Storage Blk Time (%)	0	3		0	0			
Queuing Penalty (veh)	1	0		0	0			

Intersection: 7: SR 99 SB Ramps & Woollomes

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	LTR	R
Maximum Queue (ft)	289	124	76	277	143	183
Average Queue (ft)	185	43	36	125	53	99
95th Queue (ft)	297	96	68	237	102	157
Link Distance (ft)	262	262		465	481	
Upstream Blk Time (%)	3					
Queuing Penalty (veh)	16					
Storage Bay Dist (ft)			150			300
Storage Blk Time (%)				4		
Queuing Penalty (veh)				2		

Intersection: 8: SR 99 NB Ramps & Woollomes

Movement	EB	EB	WB	NB	NB	NB
Directions Served	L	LT	TR	L	T	R
Maximum Queue (ft)	210	254	209	258	46	72
Average Queue (ft)	116	171	114	138	14	25
95th Queue (ft)	186	236	182	233	38	54
Link Distance (ft)		465	597		733	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	225			300		550
Storage Blk Time (%)	0	1		0		
Queuing Penalty (veh)	0	4		0		

Intersection: 9: Lexington & Woollomes

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	LTR	LT	TR
Maximum Queue (ft)	108	12	72	43	89
Average Queue (ft)	60	0	36	20	46
95th Queue (ft)	94	6	59	44	75
Link Distance (ft)	597	224	406	484	484
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 51

HCS Reports - Mainline (Northbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1555	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	423	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	866	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	866	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.3	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1702	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	462	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	948	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	948	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	14.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2120	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	576	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1181	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1181	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	18.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2218	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	603	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1236	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1236	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	19.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1580	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	429	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	880	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	880	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.5	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1348	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	366	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	751	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	751	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	11.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1552	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	422	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	865	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	865	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.3	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1702	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	462	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	948	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	948	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	14.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2246	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	610	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1251	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1251	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	19.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2218	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	603	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1236	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1236	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	19.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1578	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	429	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	879	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	879	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.5	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1578	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	429	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	879	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	879	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.5	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2630	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	715	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1465	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1465	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.9	mi/h
Number of lanes, N	2	
Density, D	22.6	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2435	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	662	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1356	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1356	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3695	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1004	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2058	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2058	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	58.9	mi/h
Number of lanes, N	2	
Density, D	35.0-	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3325	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	904	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1852	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1852	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.1	mi/h
Number of lanes, N	2	
Density, D	29.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2835	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	770	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1579	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1579	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.5	mi/h
Number of lanes, N	2	
Density, D	24.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3130	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	851	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1744	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1744	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.3	mi/h
Number of lanes, N	2	
Density, D	27.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2926	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	795	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1630	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1630	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	2	
Density, D	25.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Flow Inputs and Adjustments

Volume, V	2799	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	761	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1559	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1559	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.6	mi/h
Number of lanes, N	2	
Density, D	24.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cum PP
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3887	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1056	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2165	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2165	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	56.7	mi/h
Number of lanes, N	2	
Density, D	38.2	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3602	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	979	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	2007	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	2007	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	2	
Density, D	33.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumm PP
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2895	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	787	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1613	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1613	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.4	mi/h
Number of lanes, N	2	
Density, D	25.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Northbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description:	Grapevine TIAR

Flow Inputs and Adjustments

Volume, V	3179	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	864	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1771	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1771	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.0	mi/h
Number of lanes, N	2	
Density, D	28.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS Reports - Mainline (Southbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Soutbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1621	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	440	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	903	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	903	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1583	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	430	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	882	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	882	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Soutbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1544	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	420	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	860	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	860	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1893	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	514	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1055	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1055	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	16.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1937	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	526	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1079	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1079	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	16.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1937	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	526	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1079	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1079	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	16.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Soutbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1742	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	473	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	970	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	970	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	14.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1626	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	442	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	906	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	906	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Soutbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description: Grapevine TIAR	

Flow Inputs and Adjustments

Volume, V	1544	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	420	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	860	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	860	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	13.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	1941	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	527	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1081	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1081	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	16.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2555	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	694	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1423	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1423	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	21.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Soutbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2535	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	689	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1412	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1412	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3225	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	876	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1797	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1797	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.8	mi/h
Number of lanes, N	2	
Density, D	28.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	3220	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	875	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1794	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1794	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.8	mi/h
Number of lanes, N	2	
Density, D	28.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Soutbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2575	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	700	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1434	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1434	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	22.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Flow Inputs and Adjustments

Volume, V	2480	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	674	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1382	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1382	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	21.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description: Grapevine TIAR	

Flow Inputs and Adjustments

Volume, V	3433	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	933	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1912	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1912	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	61.3	mi/h
Number of lanes, N	2	
Density, D	31.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description: Grapevine TIAR	

Flow Inputs and Adjustments

Volume, V	3476	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	945	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1936	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1936	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	60.9	mi/h
Number of lanes, N	2	
Density, D	31.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Soutbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description:	Grapevine TIAR

Flow Inputs and Adjustments

Volume, V	2612	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	710	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1455	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1455	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	22.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 99 Southbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description:	Grapevine TIAR

Flow Inputs and Adjustments

Volume, V	2560	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	696	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1426	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1426	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	21.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Southbound
From/To:	South of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description:	Grapevine TIAR

Flow Inputs and Adjustments

Volume, V	2828	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	768	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1575	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1575	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.6	mi/h
Number of lanes, N	2	
Density, D	24.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	M.Shah
Agency or Company:	Omni Means LTD.
Date Performed:	7/10/2013
Analysis Time Period:	Saturday Mid-day
Freeway/Direction:	SR 99 Soutbound
From/To:	North of Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	
Description:	Grapevine TIAR

Flow Inputs and Adjustments

Volume, V	2929	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	796	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.976	
Driver population factor, fp	1.00	
Flow rate, vp	1632	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

LOS and Performance Measures

Flow rate, vp	1632	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	64.2	mi/h
Number of lanes, N	2	
Density, D	25.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS Reports - Merge (Northbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1368	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	184	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1368	184		vph
Peak-hour factor, PHF	0.92	0.88		
Peak 15-min volume, v15	372	52		v
Trucks and buses	10	10		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.952	0.952	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1561	220	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1561 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1781	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1561 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1781	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 18.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.330	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.4	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1401	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	179	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1401	179		vph
Peak-hour factor, PHF	0.92	0.96		
Peak 15-min volume, v15	381	47		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1553	190	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1553 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1743	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1553 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1743	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.329	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.4	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1105	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	243	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1105	243		vph
Peak-hour factor, PHF	0.92	0.96		
Peak 15-min volume, v15	300	63		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1225	258	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1225 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1483	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1225 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1483	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.324	
Space mean speed in ramp influence area,	S_R = 57.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1838	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	220	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1838	220		vph
Peak-hour factor, PHF	0.92	0.90		
Peak 15-min volume, v15	499	61		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2048	251	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2048 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2299	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2048 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2299	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 22.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.346	
Space mean speed in ramp influence area,	S_R = 57.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.0	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1708	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	535	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1708	535		vph
Peak-hour factor, PHF	0.92	0.90		
Peak 15-min volume, v15	464	149		v
Trucks and buses	5	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.976	0.976	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1903	609	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1903 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2512	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1903 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2512	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 23.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.355	
Space mean speed in ramp influence area,	S_R = 56.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.8	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1428	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	127	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1428	127		vph
Peak-hour factor, PHF	0.92	0.88		
Peak 15-min volume, v15	388	36		v
Trucks and buses	10	10		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.952	0.952	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1630	152	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1630 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1782	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1630 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1782	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 18.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.330	
Space mean speed in ramp influence area,	S_R = 57.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.4	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2635	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	690	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2635	690		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	716	187		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2893	757	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2893 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3650	4700	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 2893 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3650	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 32.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.457	
Space mean speed in ramp influence area,	S_R = 54.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2635	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	967	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2635	967		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	716	263		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	2893	1062	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2893 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3955	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2893 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3955	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{R12} - 0.00627\, L_A$ = 34.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.511	
Space mean speed in ramp influence area,	S_R = 53.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 53.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2325	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	805	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2325	805		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	632	219		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2552	884	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2552 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3436	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2552 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3436	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{R12} - 0.00627\, L_A$ = 30.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.428	
Space mean speed in ramp influence area,	S_R = 55.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2325	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	854	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2325	854		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	632	232		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2552	938	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2552 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3490	4700	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 2552 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3490	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{R12} - 0.00627\, L_A$ = 31.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.435	
Space mean speed in ramp influence area,	S_R = 55.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.0	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1785	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	650	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1785	650		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	485	177		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1960	714	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1960 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2674	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1960 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2674	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 24.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.364	
Space mean speed in ramp influence area,	S_R = 56.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.6	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1785	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1014	vph
Length of first accel/decel lane	200	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1785	1014		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	485	276		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1960	1113	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1960 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3073	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1960 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3073	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 27.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.391	
Space mean speed in ramp influence area,	S_R = 56.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.0	mph

HCS Reports - Merge (Southbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1380	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	164	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1380	164		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	375	43		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1515	174	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1515 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1689	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1515 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1689	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.333	
Space mean speed in ramp influence area,	S_R = 57.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1389	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	143	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1389	143		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	377	38		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1525	152	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1525 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1677	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1525 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1677	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.333	
Space mean speed in ramp influence area,	S_R = 57.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1116	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	416	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1116	416		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	303	109		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1225	442	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1225 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1667	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1225 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1667	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.333	
Space mean speed in ramp influence area,	S_R = 57.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1914	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	223	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1914	223		vph
Peak-hour factor, PHF	0.92	0.96		
Peak 15-min volume, v15	520	58		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2122	237	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2122 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2359	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2122 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2359	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 23.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.354	
Space mean speed in ramp influence area,	S_R = 56.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.9	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1506	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	431	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1506	431		vph
Peak-hour factor, PHF	0.92	0.96		
Peak 15-min volume, v15	409	112		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1670	458	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1670 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2128	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1670 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2128	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 21.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.345	
Space mean speed in ramp influence area,	S_R = 57.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.1	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1417	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	127	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1417	127		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	385	33		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1556	135	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1556 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1691	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1556 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1691	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.333	
Space mean speed in ramp influence area,	S_R = 57.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 57.3	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1995	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	580	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1995	580		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	542	158		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2190	637	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2190 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2827	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2190 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2827	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 26.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.378	
Space mean speed in ramp influence area,	S_R = 56.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1995	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	617	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1995	617		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	542	168		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	2190	677	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2190 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2867	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2190 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2867	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 26.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.381	
Space mean speed in ramp influence area,	S_R = 56.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1705	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	850	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1705	850		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	463	231		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1872	933	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1872 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2805	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1872 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2805	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 26.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.377	
Space mean speed in ramp influence area,	S_R = 56.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 56.3	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Saturday Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1705	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1123	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1705	1123		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	463	305		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	1872	1233	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1872 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3105	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1872 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3105	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{R12} - 0.00627\, L_A$ = 28.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.399	
Space mean speed in ramp influence area,	S_R = 55.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 55.8	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2345	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	880	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2345	880		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	637	239		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	2574	966	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2574 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3540	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2574 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3540	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{R12} - 0.00627\, L_A$ = 31.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.447	
Space mean speed in ramp influence area,	S_R = 54.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.7	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2345	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1088	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2345	1088		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	637	296		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, f_{HV}	0.990	0.990	
Driver population factor, f_P	1.00	1.00	
Flow rate, v_p	2574	1194	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2574 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3768	4700	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2574 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	3768	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 33.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M_S = 0.481	
Space mean speed in ramp influence area,	S_R = 53.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 53.9	mph

HCS Reports - Diverge (Northbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1702	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	334	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1702		334			vph
Peak-hour factor, PHF	0.92		0.88			
Peak 15-min volume, v15	462		95			v
Trucks and buses	10		10			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.952	0.952	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1942	399	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1942 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1942	4700	No
$v_{FO} = v_F - v_R$	1543	4700	No
v_R	399	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1942 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1942	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.464

Space mean speed in ramp influence area, S_R = 54.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.3 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1578	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	177	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1578		177			vph
Peak-hour factor, PHF	0.92		0.96			
Peak 15-min volume, v15	429		46			v
Trucks and buses	4		4			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1750	188	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1750 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1750	4700	No
$v_{FO} = v_F - v_R$	1562	4700	No
v_R	188	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1750 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1750	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 17.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.445

Space mean speed in ramp influence area, S_R = 54.8 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.8 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1578	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	473	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1578		473			vph
Peak-hour factor, PHF	0.92		0.96			
Peak 15-min volume, v15	429		123			v
Trucks and buses	4		4			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1750	503	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1750 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1750	4700	No
$v_{FO} = v_F - v_R$	1247	4700	No
v_R	503	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1750 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1750	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 17.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.473

Space mean speed in ramp influence area, S_R = 54.1 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2218	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	318	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2218		318			vph
Peak-hour factor, PHF	0.92		0.90			
Peak 15-min volume, v15	603		88			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2471	362	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2471 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2471	4700	No
$v_{FO} = v_F - v_R$	2109	4700	No
v_R	362	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2471 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2471	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 23.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.461	
Space mean speed in ramp influence area,	S_R = 54.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2218	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2218		510			vph
Peak-hour factor, PHF	0.92		0.90			
Peak 15-min volume, v15	603		142			v
Trucks and buses	5		5			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.976	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2471	581	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2471 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2471	4700	No
$v_{FO} = v_F - v_R$	1890	4700	No
v_R	581	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2471 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2471	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 23.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.480	
Space mean speed in ramp influence area,	S_R = 54.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.0	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1702	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	274	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1702		274			vph
Peak-hour factor, PHF	0.92		0.88			
Peak 15-min volume, v15	462		78			v
Trucks and buses	10		10			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.952	0.952	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1942	327	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1942 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1942	4700	No
$v_{FO} = v_F - v_R$	1615	4700	No
v_R	327	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1942 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1942	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.457

Space mean speed in ramp influence area, S_R = 54.5 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.5 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3695	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1060	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3695		1060			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	1004		288			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4056	1164	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4056 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4056	4700	No
$v_{FO} = v_F - v_R$	2892	4700	No
v_R	1164	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 4056 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4056	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 37.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.533

Space mean speed in ramp influence area, S_R = 52.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 52.7 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3887	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1252	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3887		1252			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	1056		340			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4267	1374	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4267 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4267	4700	No
$v_{FO} = v_F - v_R$	2893	4700	No
v_R	1374	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 4267 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4267	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 38.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D_S = 0.552

Space mean speed in ramp influence area, S_R = 52.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 52.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2835	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2835		510			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	770		139			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3112	560	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3112	4700	No
$v_{FO} = v_F - v_R$	2552	4700	No
v_R	560	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 3112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3112	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 29.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.478

Space mean speed in ramp influence area, S_R = 54.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2895	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	570	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2895		570			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	787		155			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3178	626	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3178 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3178	4700	No
$v_{FO} = v_F - v_R$	2552	4700	No
v_R	626	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3178 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3178	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 29.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.484	
Space mean speed in ramp influence area,	S_R = 53.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 53.9	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2630	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	845	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2630		845			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	715		230			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2887	928	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2887 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2887	4700	No
$v_{FO} = v_F - v_R$	1959	4700	No
v_R	928	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2887 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2887	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 27.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.512

Space mean speed in ramp influence area, S_R = 53.2 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.2 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Nortbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2926	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1141	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2926		1141			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	795		310			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3212	1253	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3212 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3212	4700	No
$v_{FO} = v_F - v_R$	1959	4700	No
v_R	1253	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3212 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3212	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 29.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.541

Space mean speed in ramp influence area, S_R = 52.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 52.6 mph

HCS Reports - Diverge (Southbound)

- Existing Conditions
- Existing + Project Conditions
- Cumulative Conditions
- Cumulative Plus Project Conditions

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1941	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	435	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1941		435			vph
Peak-hour factor, PHF	0.92		0.96			
Peak 15-min volume, v15	527		113			v
Trucks and buses	4		4			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2152	462	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2152 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2152	4700	No
$v_{FO} = v_F - v_R$	1690	4700	No
v_R	462	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2152 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2152	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 21.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.470	
Space mean speed in ramp influence area,	S_R = 54.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.2	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1893	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	179	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1893		179			vph
Peak-hour factor, PHF	0.92		0.96			
Peak 15-min volume, v15	514		47			v
Trucks and buses	4		4			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2099	190	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2099 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2099	4700	No
$v_{FO} = v_F - v_R$	1909	4700	No
v_R	190	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2099 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2099	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 20.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.445

Space mean speed in ramp influence area, S_R = 54.8 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.8 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Sat Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1742	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	626	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1742		626			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	473		165			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1912	666	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1912 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1912	4700	No
$v_{FO} = v_F - v_R$	1246	4700	No
v_R	666	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1912 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1912	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 19.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.488

Space mean speed in ramp influence area, S_R = 53.8 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.8 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Sat Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1621	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	232	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1621		232			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	440		61			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1780	247	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1780 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1780	4700	No
$v_{FO} = v_F - v_R$	1533	4700	No
v_R	247	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1780 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1780	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.450	
Space mean speed in ramp influence area,	S_R = 54.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.6	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year Plus Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1626	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	246	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1626		246			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	442		67			v
Trucks and buses	10		10			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.952	0.952	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1856	281	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1856 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1856	4700	No
$v_{FO} = v_F - v_R$	1575	4700	No
v_R	281	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12}/2	No	

If yes, v_{12A} = 1856 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1856	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.453	
Space mean speed in ramp influence area,	S_R = 54.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.6	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Existing Year 2013
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1621	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	166	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1621		166			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	440		45			v
Trucks and buses	10		10			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.952	0.952	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1850	189	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1850 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1850	4700	No
$v_{FO} = v_F - v_R$	1661	4700	No
v_R	189	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 $v_{12}/2$	No	

If yes, v_{12A} = 1850 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1850	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.445	
Space mean speed in ramp influence area,	S_R = 54.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.8	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Sat Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2929	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1224	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2929		1224			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	796		333			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3216	1344	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3216 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3216	4700	No
$v_{FO} = v_F - v_R$	1872	4700	No
v_R	1344	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3216 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3216	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = D_D = 30.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D_S = 0.549	
Space mean speed in ramp influence area,	S_R = 52.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 52.4	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	Sat Mid-day
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description:	Grapevine TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2535	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	830	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2535		830			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	689		226			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2783	911	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2783 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2783	4700	No
$v_{FO} = v_F - v_R$	1872	4700	No
v_R	911	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2783 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2783	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 26.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.510	
Space mean speed in ramp influence area,	S_R = 53.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 53.3	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2560	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	565	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2560		565			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	696		154			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2810	620	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2810 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2810	4700	No
$v_{FO} = v_F - v_R$	2190	4700	No
v_R	620	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12}/2	No	

If yes, v_{12A} = 2810 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2810	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 26.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.484

Space mean speed in ramp influence area, S_R = 53.9 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.9 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine TIAR	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2480	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2480		485			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	674		132			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2723	532	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2723 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2723	4700	No
$v_{FO} = v_F - v_R$	2191	4700	No
v_R	532	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 2723 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2723	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 26.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.476

Space mean speed in ramp influence area, S_R = 54.1 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035 + Proj
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3476	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1131	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3476		1131			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	945		307			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3816	1242	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3816 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3816	4700	No
$v_{FO} = v_F - v_R$	2574	4700	No
v_R	1242	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3816 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3816	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 35.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	D_S = 0.540	
Space mean speed in ramp influence area,	S_R = 52.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 52.6	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	M.Shah
Agency/Co.:	Omni Means LTD.
Date performed:	7/10/2013
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 99 Southbound
Junction:	Woollomes Ave
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Year 2035
Description: Grapevine	TIAR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3220	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	875	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3220		875			vph
Peak-hour factor, PHF	0.92		0.92			
Peak 15-min volume, v15	875		238			v
Trucks and buses	2		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.990	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3535	961	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3535 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3535	4700	No
$v_{FO} = v_F - v_R$	2574	4700	No
v_R	961	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 3535 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3535	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 33.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.514

Space mean speed in ramp influence area, S_R = 53.2 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 53.2 mph

APPENDIX 6.0
OTHER SECTIONS REQUIRED BY CEQA

APPENDIX 6-1: CHILD CARE FACILITIES NEEDS ASSESSMENT FOR THE GRAPEVINE PROJECT

Child Care Demand Estimate Methodology:

The methodology for estimating child care demand for the project is based on resources provided by and /or recommended by the Early Childhood Council of Kern. These resources include:

- *The Sonoma County Child Care Facilities Development Handbook* (Sonoma County, 2010). The handbook provides a sample demand analysis utilizing two methods of determining demand for licensed child care (Sonoma County, 2010; pgs. 12-14)
- *Kern County Child Care Policy Analysis and Strategy Study* (Brion & Associates, 2005)
- *Kern County Child Care Needs Assessment 2009* (Early Childhood Council of Kern, 2009)
- Communications with Early Childhood Council of Kern staff

The Sonoma County Child Care Facilities Development Handbook (Sonoma County Handbook) provides a sample project-level demand analysis based on a mixed-use project, Sonoma Mountain Village, which incorporates residential, office and retail/commercial uses (Sonoma County, 2010; pg. 12).

The methodology used in the Sonoma County Handbook is similar to that used in a Kern County resource (Brion & Associates, 2005; pgs. 7-17). This assessment follows the methodology outlined in the Sonoma County Handbook, which breaks the process of estimating child care demand into several steps:

1. Estimate the adult population of the project.

2. Apply data on children as a percent of total population by age group to the adult population to determine number of children who may need services.

3. Apply Labor Force Participation Rates (LFPRs) by age to estimate "children with working parents by age." This step is not applied in this assessment, because the entire adult population considered in the assessment is the employee pool of the proposed project. Thus, labor force participation for this population is by definition 100%.

4. Estimate "demand for licensed care." The calculations are typically broken out into age groups for different types of child care: infant care, preschool, and school age:[1]

    - 37% of infants with working parents
    - 70% of preschoolers with working parents
    - 39% of school-age children with working parents

(Sonoma County Child Care Planning Council, 2010; pg. 13; and Early Childhood Council of Kern, 2013a.)

[1] Different government entities administering child care divide children into different age subgroups. This assessment follows the age designations recommended by staff at the Early Childhood Council of Kern: "birth to age 2," "3 to 5 years," and "6-12 years." and "15-17 years" (Early Childhood Council of Kern, 2013a.)

Application of the Methodology to the Grapevine Project:

Step 1: Estimate the adult population.

For the purposes of the project, the population present is estimated to be 617, the number of employees working on-site (City of Delano, 2013; pg. 5). In estimating population, this assessment uses the 2010 Census as it is the most recent. The population of Delano as of the 2010 census was 53,041 (U.S. Census Bureau, 2010a).

Step 2: Calculate children by age group as a percentage of the adult population.

As of 2010, Delano's population aged 12 and under numbered as follows.

- birth to age 2: 2747
- 3 to 5 years: 2614
- 6 to 12 years: 6216

(Data derived from U.S. Census, 2010b (2010 Census, Summary File 1 Table P14 ZCTA5 93215))

Comparing these figures to Delano's 2010 population as a whole (53,041) yields the following figures on each age group as a percentage of total population:

- birth to age 2: 5%
- 3 to 5 years: 5%
- 6 to 12 years: 12%

Based on these percentages, the total percentage of children aged 14 and older in Delano as of the last census comprised approximately 22%. This is somewhat higher than the Sonoma County Child Care Facilities Development Handbook states is the typical expected range: "Children 0 to 13 typically comprise about a low of 12% to a high of 20% of total population, depending on the location." (Sonoma County Child Care Planning Council, 2010.) However, the overall population of Delano is significantly younger than the state median: the City has a median resident age of 28.5 years, compared to the California median age of 35.2 years (U.S. Census, 2013; pg. 1; see also Brion & Associates, 2005; pg. 38). Thus, it is not surprising that the proportion of children in the population would also be higher than average.

Applying the percentages above to the project's projected employee population of 617 results in the following estimates of the number of children of the project's employee pool:

- birth to age 2: 31
- 3 to 5 years: 31
- 6 to 12 years: 74

Step 3: estimate demand for licensed child care based on the following rates[2]:

- 37% of infants with working parents
- 70% of preschoolers with working parents
- 39% of school-age children with working parents

Applying these percentages to the estimated number of children of project employees yields the following child care demand estimates:

- birth to age 2: 11 infant/toddler care spaces needed
- 3 to 5 years: 22 preschool-age child care spaces needed
- 6 to 12: 29 school-age child care spaces needed
- Total child care spaces needed: 72

Child Care Supply in the City of Delano

According to data supplied by the Early Childhood Council of Kern, child care providers in the City include the following:

- 72 small-to-large licensed family child care providers in the City, with approximately 822 spaces for children from birth to age 12
- Thirteen center based programs, including:
    - one center-based, non-government subsidized program with 30 spaces for preschool-age children
    - three state and federally funded programs licensed to serve a total of 235 preschool age children in full day / full year programs
    - seven state and federally funded programs licensed to serve 652 preschool-age children in half-day programs (these sites operate on the school year calendar and therefore are not full year.)

(Early Childhood Council of Kern, 2013a; and Early Childhood Council of Kern, 2013c.)

Estimating the number of open spaces available in these programs is not precise, because vacancy rates for non-subsidized child care centers and home-based providers are not tracked systematically (Early Childhood Council of Kern, 2013c; and Early Childhood Council of Kern, 2009; pgs. 15 and 17).

At the time this child care assessment was written, staff with the Early Child Care Council of Kern estimated the number of vacancies at center-based child care facilities in the City at 179. The 2008 Kern County Child Care Needs Assessment estimated that non-subsidized providers in the county had an

[2] Rates employed here were supplied by Tammy Burns of the Early Childhood Council of Kern and are "derived from a meta-analysis of 15 surveys/studies" (Early Childhood Council of Kern, 2013a). Rates in the Sonoma County Child Care Facilities Development Handbook are similar: 25%-37% for infants; 30%-85% for preschoolers and 38% to 50% for school-age children (Sonoma County, 2010; pg.13).

average vacancy rate of 14% (Early Childhood Council of Kern, 2009; pg. 15). Applying these estimates to the City's current child care supply data results in the following estimate of vacancies:

- Center-based child care facilities in the City: **179 vacancies**
- At the 72 licensed family child care providers in the City, approximately **155 vacancies** for children from birth to age 12

The estimated total vacancies in the City is therefore **334.**

CONCLUSION

Child care needs for the employees of the project are estimated to be approximately 72. Therefore, with 334 vacancies estimated to be available for child care for ages 0-12, the current estimated child care capacity in the City is adequate to accommodate child care needs associated with the project.

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