Appendix A

Air Quality & Greenhouse Gas Impact Assessment

AIR QUALITY & GREENHOUSE GAS IMPACT ANALYSIS

FOR

JUNIPER ELEMENTARY SCHOOL PROJECT

ATWATER ELEMENTARY SCHOOL DISTRICT

ATWATER, CA

APRIL 2020

PREPARED FOR:
ODELL PLANNING & RESEARCH, INC.
49346 ROAD 426, SUITE 2
OAKHURST, CA 93644

PREPARED BY:

AMBIENT
AIR QUALITY & NOISE CONSULTING
612 12TH STREET, SUITE 201
PASO ROBLES, CA 93446

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LIST OF COMMON TERMS & ACRONYMS

AAM	Annual Arithmetic Mean
AHERA	Asbestos Hazard Emergency Response Act
ASHAA	Asbestos School Hazard Abatement Act
ASHARA	Asbestos School Hazard Abatement and Reauthorization Act
ATCM	Airborne Toxic Control Measure
CAAQS	California Ambient Air Quality Standards
ARB	California Air Resources Board
CCAA	California Clean Air Act
CCAR	California Climate Action Registry
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DPM	Diesel-Exhaust Particulate Matter or Diesel-Exhaust PM
DRRP	Diesel Risk Reduction Plan
FCAA	Federal Clean Air Act
GHG	Greenhouse Gases
HAP	Hazardous Air Pollutant
IPCC	Intergovernmental Panel on Climate Change
LOS	Level of Service
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NESHAPs	National Emission Standards for HAPs
NO_x	Oxides of Nitrogen
O_3	Ozone
Pb	Lead
PM	Particulate Matter
PM_{10}	Particulate Matter (less than 10 μm)
$PM_{2.5}$	Particulate Matter (less than 2.5 μm)
ppb	Parts per Billion
ppm	Parts per Million
ROG	Reactive Organic Gases
SIP	State Implementation Plan
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	Sulfur Dioxide
SRTS	Safe Routes to School
TAC	Toxic Air Contaminant
TSCA	Toxic Substances Control Act
$\mu g/m^3$	Micrograms per cubic meter
U.S. EPA	United State Environmental Protection Agency

INTRODUCTION

This report describes the existing environment in the project vicinity and identifies potential air quality and greenhouse gas impacts associated with the proposed project. Project impacts are evaluated relative to applicable thresholds of significance. Mitigation measures have been identified for significant impacts.

PROPOSED PROJECT

The Atwater Elementary School District (District) is proposing to undertake the Juniper Elementary School Project (project). The proposed project includes the construction and operation of a new elementary school on a 10-acre site owned by the District. The site is located at the northwest corner of Juniper Avenue and Bridgewater Street in the city of Atwater, Merced County, CA. Figures 1 and 2 depict the Project Location and Project Site.

The elementary school would serve up to 600 students in grades TK-6. The campus would have 27 classrooms, administrative offices, a multi-purpose building, hardcourt areas and athletic fields which may include lighting. The school would be staffed by up to 45 employees, including administrators, faculty, and support staff. The school would be in regular session on weekdays from late August to early June, but may host special events and classes during evenings, on weekends, and during summer recess. The District estimates that construction of the project would begin in late 2021, with operation of the proposed elementary school beginning in August 2023.

AIR QUALITY

EXISTING SETTING

The project is located within the San Joaquin Valley Air Basin (SJVAB). The SJVAB is within the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). Air quality in the SJVAB is influenced by a variety of factors, including topography, local and regional meteorology. Factors affecting regional and local air quality are discussed below.

TOPOGRAPHY, METEOROLOGY, AND POLLUTANT DISPERSION

The dispersion of air pollution in an area is determined by such natural factors as topography, meteorology, and climate, coupled with atmospheric stability conditions and the presence of inversions. The factors affecting the dispersion of air pollution with respect to the SJVAB are discussed below.

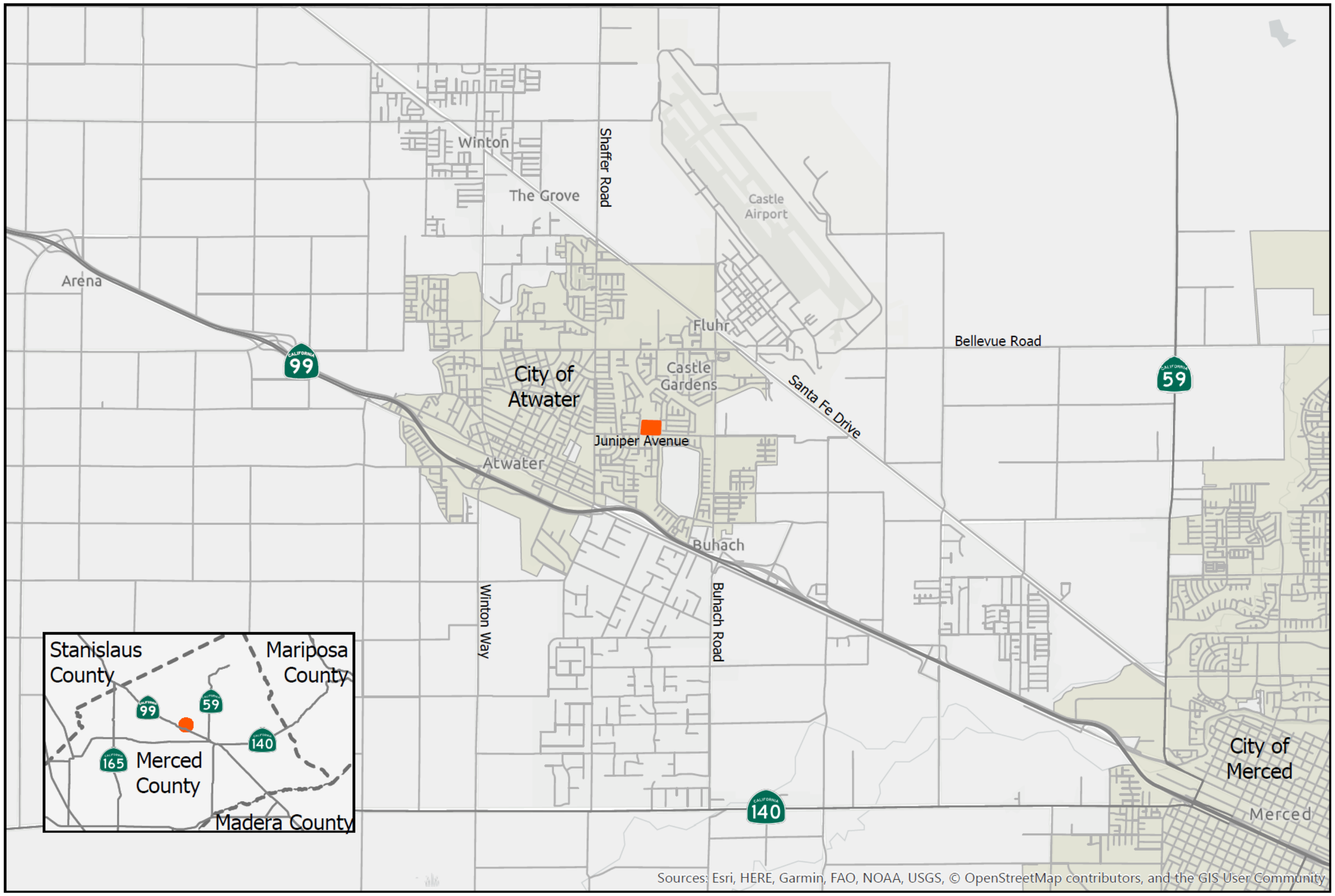
Topography

The SJVAB occupies the southern half of the Central Valley. The SJVAB is open to the north, and is surrounded by mountain ranges on all other sides. The Coast Ranges, which have an average elevation of 3,000 feet, are along on the western boundary of the SJVAB, while the Sierra Nevada Mountains (8,000 to 14,000 feet in elevation) are along the eastern border. The San Emigdio Mountains, which are part of the Coast Ranges, and the Tehachapi Mountains, which are part of the Sierra Nevada, form the southern boundary, and have an elevation of 6,000 to 8,000 feet. The SJVAB is mostly flat with a downward gradient in terrain to the northwest.

Meteorology and Climate

The SJVAB has an inland Mediterranean climate that is strongly influenced by the presence of mountain ranges. The mountain ranges to the west and south induce winter storms from the Pacific Ocean to release precipitation on the western slopes producing a partial rain shadow over the valley. In addition, the mountain ranges block the free circulation of air to the east, trapping stable air in the valley for extended periods during the cooler half of the year.

Figure 1. Project Location



Project Location **Figure 1**

Juniper Elementary School Project
Atwater Elementary School District

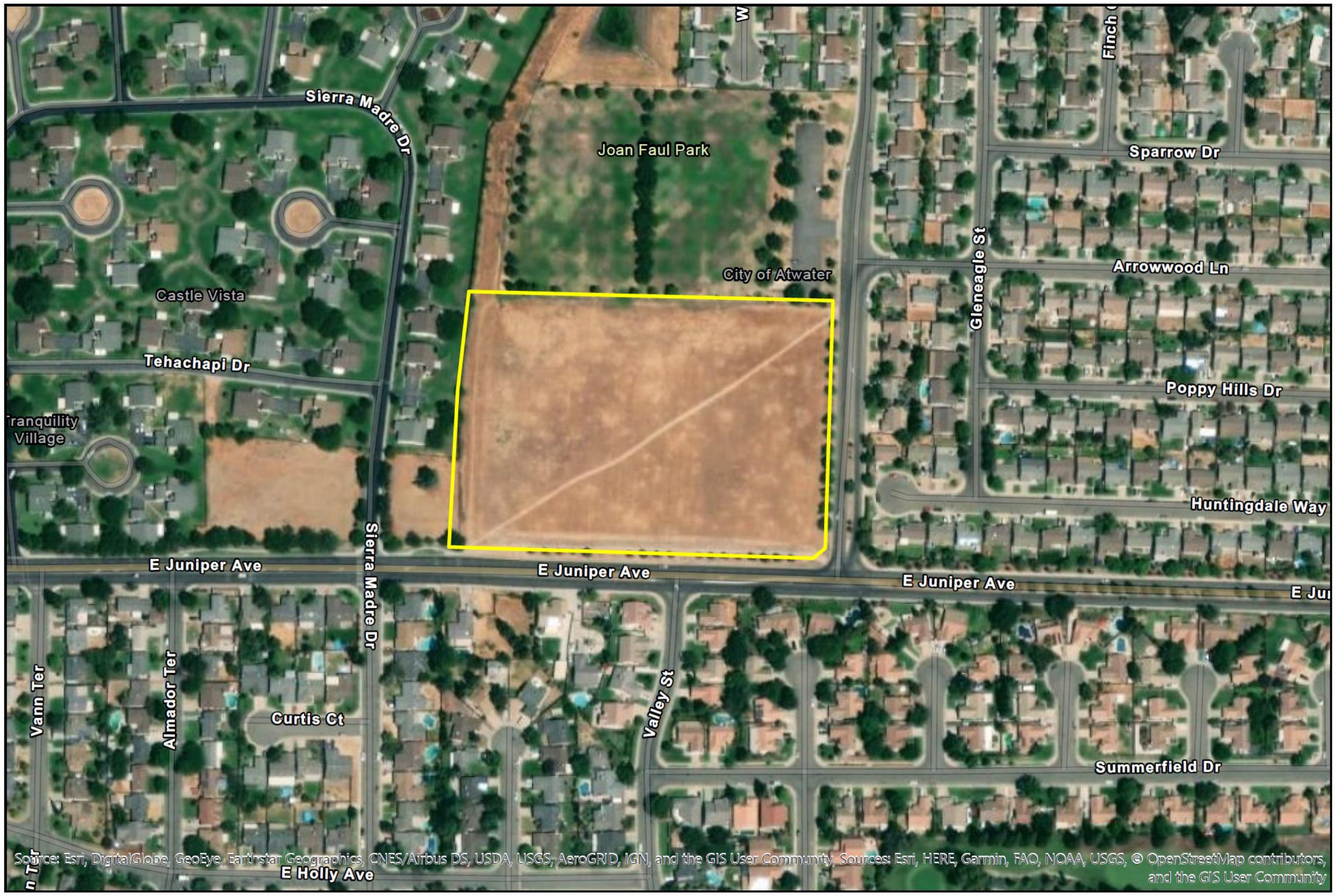
ODELL Planning & Research, Inc.
Environmental Planning • School Facility Planning • Demographics

Project Site
City Limits

0 0.5 1 2 Miles
N

Source: OPR 2020

Figure 2. Project Site



Project Site **Figure 2**

Juniper Elementary School Project
Atwater Elementary School District

ODELL Planning & Research, Inc.
Environmental Planning • School Facility Planning • Demographics

0 125 250 500 Feet N

Source: OPR 2020

Winter in the SJVAB is characterized as mild and fairly humid, while the summer is typically hot, dry, and cloudless. The climate is a result of the topography and the strength and location of a semi permanent, subtropical high-pressure cell. During the summer months, the Pacific high-pressure cell is centered over the northeastern Pacific Ocean, resulting in stable meteorological conditions and a steady northwesterly wind flow. Upwelling of cold ocean water from below to the surface as a result of the northwesterly flow produces a band of cold water off the California coast. In winter, the Pacific high-pressure cell weakens and shifts southward, resulting in wind flow offshore, the absence of upwelling, and the occurrence of storms.

The annual temperature, humidity, precipitation, and wind patterns reflect the topography of the SJVAB and the strength and location of the semi permanent, subtropical high-pressure cell. Summer temperatures that often exceed 100 degrees Fahrenheit (°F) and clear sky conditions are favorable to ozone formation. Most of the precipitation in the valley occurs as rainfall during winter storms. The winds and unstable atmospheric conditions associated with the passage of winter storms result in periods of low air pollution and excellent visibility. However, between winter storms, high pressure and light winds lead to the creation of low-level temperature inversions and stable atmospheric conditions, which can result in higher pollutant concentrations. The orientation of the wind flow pattern in the SJVAB is parallel to the valley and mountain ranges. Summer wind conditions promote the transport of ozone and precursors from the San Francisco Bay Area through the Carquinez Strait, a gap in the Coast Ranges, and low-mountain passes such as Altamont Pass and Pacheco Pass. During the summer, predominant wind direction is from the northwest. During the winter, the predominant wind direction is from the southeast. Calm conditions are also predominant during the winter (ARB 1992).

The climate in the project area is semi-arid, with an annual normal precipitation of approximately 12 inches. Temperatures in the project area range from an average minimum of approximately 36°F, in January, to an average maximum of 97°F, in July (WRCC 2020).

Atmospheric Stability and Inversions

Stability describes the resistance of the atmosphere to vertical motion. The stability of the atmosphere is dependent on the vertical distribution of temperature with height. Stability categories range from "Extremely Unstable" (Class A), through Neutral (Class D), to "Stable" (Class F). Unstable conditions often occur during daytime hours when solar heating warms the lower atmospheric layers sufficiently. Under Class A stability conditions, large fluctuations in horizontal wind direction occur coupled with large vertical mixing depths. Under Class B stability conditions, wind direction fluctuations and the vertical mixing depth are less pronounced because of a decrease in the amount of solar heating. Under Class C stability conditions, solar heating is weak along with horizontal and vertical fluctuations because of a combination of thermal and mechanical turbulence. Under Class D stability conditions, vertical motions are primarily generated by mechanical turbulence. Under Class E and Class F stability conditions, air pollution emitted into the atmosphere travels downwind with poor dispersion. The dispersive power of the atmosphere decreases with progression through the categories from A to F.

With respect to the SJVAB, Classes D through F are predominant during the late fall and winter because of cool temperatures and entrapment of cold air near the surface. March and August are transition months with equally occurring percentages of Class F and Class A. During the spring months of April and May and the summer months of June and July, Class A is predominant. The fall months of September, October, and November have comparable percentages of Class A and Class F.

An inversion is a layer of warmer air over a layer of cooler air. Inversions influence the mixing depth of the atmosphere, which is the vertical depth available for diluting air pollution near the ground, thus significantly affecting air quality conditions. The SJVAB experiences both surface-based and elevated inversions. The shallow surface-based inversions are present in the morning but are often broken by daytime heating of the air layers near the ground. The deep elevated inversions occur less frequently than the surface-based inversions but generally result in more severe stagnation. The surface-based inversions occur more frequently in the fall, and the stronger elevated inversions usually occur during December and January.

AIR POLLUTANTS OF CONCERN

Criteria Air Pollutants

For the protection of public health and welfare, the Federal Clean Air Act (FCAA) required that the United States Environmental Protection Agency (U.S. EPA) establish National Ambient Air Quality Standards (NAAQS) for various pollutants. These pollutants are referred to as "criteria" pollutants because the U.S. EPA publishes criteria documents to justify the choice of standards. These standards define the maximum amount of an air pollutant that can be present in ambient air. An ambient air quality standard is generally specified as a concentration averaged over a specific time period, such as one hour, eight hours, 24 hours, or one year. The different averaging times and concentrations are meant to protect against different exposure effects. Standards established for the protection of human health are referred to as primary standards; whereas, standards established for the prevention of environmental and property damage are called secondary standards. The FCAA allows states to adopt additional or more health-protective standards. The air quality regulatory framework and ambient air quality standards are discussed in greater detail later in this report.

The following provides a summary discussion of the primary and secondary criteria air pollutants of primary concern. In general, primary pollutants are directly emitted into the atmosphere, and secondary pollutants are formed by chemical reactions in the atmosphere. Adverse effects associated with the criteria air pollutants of primary concern, with regard to human health, are also summarized in Table 1. These air pollutants of primary concern include ozone, particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead, and carbon monoxide (CO).

Table 1. Common Criteria Air Pollutants & Adverse Effects

Pollutant	Human Health & Welfare Effects
Particulate Matter (PM_{10} & $PM_{2.5}$)	Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease. Impairs visibility (haze).
Ozone (O_3)	Irritates and causes inflammation of the mucous membranes and lung airways; causes wheezing, coughing and pain when inhaling deeply; decreases lung capacity; aggravates lung and heart problems. Damages plants; reduces crop yield. Damages rubber, some textiles, and dyes.
Sulfur Dioxide (SO_2)	Respiratory irritant. Aggravates lung and heart problems. In the presence of moisture and oxygen, sulfur dioxide converts to sulfuric acid which can damage marble, iron and steel; damage crops and natural vegetation. Impairs visibility. A precursor to acid rain.
Carbon Monoxide (CO)	Reduces the ability of blood to deliver oxygen to vital tissues, effecting the cardiovascular and nervous system. Impairs vision, causes dizziness, and can lead to unconsciousness or death.
Nitrogen Dioxide (NO_2)	Respiratory irritant; aggravates lung and heart problems. A precursor to ozone and acid rain. Contributes to global warming, and nutrient overloading which deteriorates water quality. Causes brown discoloration of the atmosphere.
Lead	Anemia, high blood pressure, brain and kidney damage, neurological disorders, cancer, lowered IQ. Affects animals, plants, and aquatic ecosystems.

Source: CAPCOA 2020

Ozone (O_3) is a reactive gas consisting of three atoms of oxygen. In the troposphere, it is a product of the photochemical process involving the sun's energy. Ozone is not directly emitted, but is a secondary pollutant that is formed when NO_X and volatile organic compounds (VOC) react in the presence of sunlight. Ozone at the earth's surface causes numerous adverse health effects and is a criteria pollutant. It is a major component of smog. In the stratosphere, ozone exists naturally and shields Earth from harmful incoming ultraviolet radiation.

High concentrations of ground level ozone can adversely affect the human respiratory system and aggravate cardiovascular disease and many respiratory ailments. Ozone also damages natural ecosystems such as forests and foothill communities, agricultural crops, and some man-made materials, such as rubber, paint, and plastics.

Reactive Organic Gas (ROG) is a reactive chemical gas, composed of hydrocarbon compounds that may contribute to the formation of smog by their involvement in atmospheric chemical reactions. No separate health standards exist for ROG as a group. Because some compounds that make up ROG are also toxic, like the carcinogen benzene, they are often evaluated as part of a toxic risk assessment. Total Organic Gases (TOGs) includes all of the ROGs, in addition to low reactivity organic compounds like methane and acetone. ROGs and VOC are subsets of TOG.

Volatile Organic Compounds (VOC) are hydrocarbon compounds that exist in the ambient air. VOCs contribute to the formation of smog and may also be toxic. VOC emissions are a major precursor to the formation of ozone. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints.

Oxides of Nitrogen (NO_X) are a family of gaseous nitrogen compounds and is a precursor to the formation of ozone and particulate matter. The major component of NO_X, nitrogen dioxide (NO_2), is a reddish-brown gas that is toxic at high concentrations. NO_X results primarily from the combustion of fossil fuels under high temperature and pressure. On-road and off-road motor vehicles and fuel combustion are the major sources of this air pollutant.

Particulate Matter (PM), also known as particle pollution, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The size of particles is directly linked to their potential for causing health problems. U.S. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. U.S. EPA groups particle pollution into three categories based on their size and where they are deposited:

- "Inhalable coarse particles ($PM_{2.5}$- PM_{10})," such as those found near roadways and dusty industries, are between 2.5 and 10 micrometers in diameter. $PM_{2.5\text{-}10}$ is deposited in the thoracic region of the lungs.
- "Fine particles ($PM_{2.5}$)," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air. They penetrate deeply into the thoracic and alveolar regions of the lungs.
- "Ultrafine particles (UFP)," are very small particles less than 0.1 micrometers in diameter largely resulting from the combustion of fossils fuels, meat, wood and other hydrocarbons. While UFP mass is a small portion of $PM_{2.5}$, its high surface area, deep lung penetration, and transfer into the bloodstream can result in disproportionate health impacts relative to their mass.

PM_{10}, $PM_{2.5}$, and UFP include primary pollutants (emitted directly to the atmosphere) as well as secondary pollutants (formed in the atmosphere by chemical reactions among precursors). Generally speaking, $PM_{2.5}$ and UFP are emitted by combustion sources like vehicles, power generation, industrial processes, and wood burning, while PM_{10} sources include these same sources plus roads and farming activities. Fugitive windblown dust and other area sources also represent a source of airborne dust.

Numerous scientific studies have linked both long- and short-term particle pollution exposure to a variety of health problems. Long-term exposures, such as those experienced by people living for many years in areas with high particle levels, have been associated with problems such as reduced lung function and the development of chronic bronchitis and even premature death. Short-term exposures to particles (hours or days) can aggravate lung disease, causing asthma attacks and also acute (short-term) bronchitis, and may also increase susceptibility to respiratory infections. In people with heart disease, short-term exposures have been linked to heart attacks and arrhythmias. Healthy children and adults have not been reported to suffer serious effects from short term exposures, although they may experience temporary minor irritation when particle levels are elevated.

Carbon Monoxide (CO) is an odorless, colorless gas that is highly toxic. It is formed by the incomplete combustion of fuels and is emitted directly into the air (unlike ozone). The main source of CO is on-road motor vehicles. Other CO sources include other mobile sources, miscellaneous processes, and fuel combustion from stationary sources. Because of the local nature of CO problems, the California Air Resources Board (ARB) and U.S. EPA designate urban areas as CO nonattainment areas instead of the entire basin as with ozone and PM_{10}. Motor vehicles are by far the largest source of CO emissions. Emissions from motor vehicles have been declining since 1985, despite increases in vehicle miles traveled, with the introduction of new automotive emission controls and fleet turnover.

Sulfur Dioxide (SO_2) is a colorless, irritating gas with a "rotten egg" smell formed primarily by the combustion of sulfur-containing fossil fuels. However, like airborne NO_X, suspended SO_X particles contribute to the poor visibility. These SO_X particles can also combine with other pollutants to form $PM_{2.5}$. The prevalence of low-sulfur fuel use has minimized problems from this pollutant.

Lead (Pb) is a metal that is a natural constituent of air, water, and the biosphere. Lead is neither created nor destroyed in the environment, so it essentially persists forever. The health effects of lead poisoning include loss of appetite, weakness, apathy, and miscarriage. Lead can also cause lesions of the neuromuscular system, circulatory system, brain, and gastrointestinal tract. Gasoline-powered automobile engines were a major source of airborne lead through the use of leaded fuels. The use of leaded fuel has been mostly phased out, with the result that ambient concentrations of lead have dropped dramatically.

Hydrogen Sulfide (H_2S) is associated with geothermal activity, oil and gas production, refining, sewage treatment plants, and confined animal feeding operations. Hydrogen sulfide is extremely hazardous in high concentrations; especially in enclosed spaces (800 ppm can cause death). OSHA regulates workplace exposure to H_2S.

Other Pollutants

The State of California has established air quality standards for some pollutants not addressed by Federal standards. The ARB has established State standards for hydrogen sulfide, sulfates, vinyl chloride, and visibility reducing particles. The following section summarizes these pollutants and provides a description of the pollutants' physical properties, health and other effects, sources, and the extent of the problems.

Sulfates (SO_4^{2-}) are the fully oxidized ionic form of sulfur. Sulfates occur in combination with metal and/or hydrogen ions. In California, emissions of sulfur compounds occur primarily from the combustion of petroleum-derived fuels (e.g., gasoline and diesel fuel) that contain sulfur. This sulfur is oxidized to SO_2 during the combustion process and subsequently converted to sulfate compounds in the atmosphere. The conversion of SO_2 to sulfates takes place comparatively rapidly and completely in urban areas of California due to regional meteorological features.

The ARB sulfates standard is designed to prevent aggravation of respiratory symptoms. Effects of sulfate exposure at levels above the standard include a decrease in ventilator function, aggravation of asthmatic symptoms, and an increased risk of cardio-pulmonary disease. Sulfates are particularly effective in degrading visibility, and, due to the fact that they are usually acidic, can harm ecosystems and damage materials and property.

Visibility Reducing Particles: Are a mixture of suspended particulate matter consisting of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. The standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

Vinyl Chloride (C_2H_3Cl or VCM) is a colorless gas that does not occur naturally. It is formed when other substances such as trichloroethane, trichloroethylene, and tetrachloro-ethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC) which is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Odors

Typically, odors are generally regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from the psychological (i.e. irritation, anger, or anxiety) to the physiological, including circulatory and respiratory effects, nausea, vomiting, and headache.

The ability to detect odors varies considerably among the population and overall is quite subjective. Some individuals have the ability to smell very minute quantities of specific substances; others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor and in fact an odor that is offensive to one person may be perfectly acceptable to another (e.g., fast food restaurant). It is important to also note that an unfamiliar odor is more easily detected and is more likely to cause complaints than a familiar one. This is because of the phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity.

Quality and intensity are two properties present in any odor. The quality of an odor indicates the nature of the smell experience. For instance, if a person describes an odor as flowery or sweet, then the person is describing the quality of the odor. Intensity refers to the strength of the odor. For example, a person may use the word strong to describe the intensity of an odor. Odor intensity depends on the odorant concentration in the air. When an odorous sample is progressively diluted, the odorant concentration decreases. As this occurs, the odor intensity weakens and eventually becomes so low that the detection or recognition of the odor is quite difficult. At some point during dilution, the concentration of the odorant reaches a detection threshold. An odorant concentration below the detection threshold means that the concentration in the air is not detectable by the average human.

Neither the state nor the federal governments have adopted rules or regulations for the control of odor sources. The SJVAPCD does not have an individual rule or regulation that specifically addresses odors; however, odors would be subject to SJVAPCD *Rule 4102, Nuisance*. Any actions related to odors would be based on citizen complaints to local governments and the SJVAPCD.

Toxic Air Contaminants

Toxic air contaminants (TACs) are air pollutants that may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air, but due to their high toxicity, they may pose a threat to public health even at very low concentrations. Because there is no threshold level below which adverse health impacts are not expected to occur, TACs differ from criteria pollutants for which acceptable levels of exposure can be determined and for which state and federal governments have set ambient air quality standards. TACs, therefore, are not considered "criteria pollutants" under either the FCAA or the California Clean Air Act (CCAA), and are thus not subject to National or California ambient air quality standards (NAAQS and CAAQS, respectively). Instead, the U.S. EPA and the ARB regulate Hazardous Air Pollutants (HAPs) and TACs, respectively, through statutes and regulations that generally require the use of the maximum or best available control technology to limit emissions. In conjunction with SJVAPCD rules, these federal and state statutes and regulations establish the regulatory framework for TACs. At the national levels, the U.S. EPA has established National Emission Standards for HAPs (NESHAPs), in accordance with the requirements of the FCAA and subsequent amendments. These are technology-based source-specific regulations that limit allowable emissions of HAPs.

Within California, TACs are regulated primarily through the Tanner Air Toxics Act (AB 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588). The Tanner Act sets forth a formal procedure for ARB to designate substances as TACs. Within California, a majority of estimated health risks associated with TACs are attributed to diesel particulate matter (DPM). In addition to DPM, other TACs of potential concern in California include benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene.

Diesel Particulate Matter (DPM) was identified as a TAC by the ARB in August 1998. DPM is emitted from both mobile and stationary sources. In California, on-road diesel-fueled vehicles contribute approximately 40% of the statewide total, with an additional 57 percent attributed to other mobile sources such as construction and mining equipment, agricultural equipment, and transport refrigeration units. Stationary sources, contributing about 3 percent of emissions, include shipyards, warehouses, heavy equipment repair yards, and oil and gas production operations. Emissions from these sources are from diesel-fueled internal combustion engines. Stationary sources that report DPM emissions also include heavy construction, manufacturers of asphalt paving materials and blocks, and diesel-fueled electrical generation facilities (ARB 2013).

In October 2000, the ARB issued a report entitled: "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles", which is commonly referred to as the Diesel Risk Reduction Plan (DRRP). The DRRP provides a mechanism for combating the DPM problem. The goal of the DRRP is to reduce concentrations of DPM by 85 percent by the year 2020, in comparison to year 2000 baseline emissions. The key elements of the DRRP are to clean up existing engines through engine retrofit emission control devices, to adopt stringent standards for new diesel engines, and to lower the sulfur content of diesel fuel to protect new, and very effective, advanced technology emission control devices on diesel engines. When fully implemented, the DRPP will significantly reduce emissions from both old and new diesel fueled motor vehicles and from stationary sources that burn diesel fuel. In addition to these strategies, the ARB continues to promote the use of alternative fuels and electrification. As a result of these actions, DPM concentrations and associated health risks in future years are projected to decline (ARB 2013, ARB 2000).

Exposure to DPM can have immediate health effects. DPM can irritate the eyes, nose, throat, and lungs, and it can cause coughs, headaches, lightheadedness, and nausea. In studies with human volunteers, Exposure to DPM also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. The elderly and people with emphysema, asthma, and chronic heart and lung disease are especially sensitive to fine-particle pollution. Because children's lungs and respiratory systems are still developing, they are also more susceptible than healthy adults to fine particles. Exposure to fine particles is associated with increased frequency of childhood illnesses and can also reduce lung function in children. In California, DPM has been identified as a carcinogen.

ASBESTOS

Asbestos is a term used for several types of naturally-occurring fibrous minerals found in many parts of California. The most common type of asbestos is chrysotile, but other types are also found in California. Serpentine rock often contains chrysotile asbestos. Serpentine rock, and its parent material, ultramafic rock, is abundant in the Sierra foothills, the Klamath Mountains, and Coast Ranges. The project site, however, is not located in an area of known ultramafic rock.

Asbestos is commonly found in ultramafic rock, including serpentine, and near fault zones. The amount of asbestos that is typically present in these rocks range from less than 1 percent up to about 25 percent, and sometimes more. Asbestos is released from ultramafic and serpentine rock when it is broken or crushed. This can happen when cars drive over unpaved roads or driveways which are surfaced with these rocks, when land is graded for building purposes, or at quarrying operations. It is also released naturally through weathering and erosion. Once released from the rock, asbestos can become airborne and may stay in the air for long periods of time.

Additional sources of asbestos include building materials and other manmade materials. The most common sources are heat-resistant insulators, cement, furnace or pipe coverings, inert filler material, fireproof gloves and clothing, and brake linings. Asbestos has been used in the United States since the early 1900's; however, asbestos is no longer allowed as a constituent in most home products and materials. Many older buildings, schools, and homes still have asbestos containing products.

Naturally-occurring asbestos was identified by ARB as a TAC in 1986. The ARB has adopted two statewide control measures which prohibits the use of serpentine or ultramafic rock for unpaved surfacing and controls dust emissions from construction, grading, and surface mining in areas with these rocks. Various other laws have also been adopted, including laws related to the control of asbestos-containing materials during the renovation and demolition of buildings.

All types of asbestos are hazardous and may cause lung disease and cancer. Health risks to people are dependent upon their exposure to asbestos. The longer a person is exposed to asbestos and the greater the intensity of the exposure, the greater the chances for a health problem. Asbestos-related disease, such as lung cancer, may not occur for decades after breathing asbestos fibers. Cigarette smoking increases the risk of lung cancer from asbestos exposure.

VALLEY FEVER

Valley fever is an infection caused by the fungus Coccidioides. The scientific name for valley fever is "coccidioidomycosis," and it's also sometimes called "desert rheumatism." The term "valley fever" usually refers to Coccidioides infection in the lungs, but the infection can spread to other parts of the body in severe cases.

Coccidioides spores circulate in the air after contaminated soil and dust are disturbed by humans, animals, or the weather. The spores are too small to see without a microscope. When people breathe in the spores, they are at risk for developing valley fever. After the spores enter the lungs, the person's body temperature allows the spores to change shape and grow into spherules. When the spherules get large enough, they break open and release smaller pieces (called endospores) which can then potentially spread within the lungs or to other organs and grow into new spherules. In extremely rare cases, the fungal spores can enter the skin through a cut, wound, or splinter and cause a skin infection.

Symptoms of valley fever may appear between 1 and 3 weeks after exposure. Symptoms commonly include fatigue, coughing, fever, shortness of breath, headaches, night sweats, muscle aches and joint pain, and rashes on the upper body or legs.

Approximately 5 to 10 percent of people who get valley fever will develop serious or long-term problems in their lungs. In an even smaller percent of people (about 1 percent), the infection spreads from the lungs to other parts of the body, such as the central nervous system (brain and spinal cord), skin, or bones and joints. Certain groups of people may be at higher risk for developing the severe forms of valley fever, such as people who have weakened immune systems. The fungus that causes valley fever, Coccidioides, can't spread from the lungs between people or between people and animals. However, in extremely rare instances, a wound infection with Coccidioides can spread valley fever to someone else, or the infection can be spread through an organ transplant with an infected organ.

For many people, the symptoms of valley fever will go away within a few months without any treatment. Healthcare providers choose to prescribe antifungal medication for some people to try to reduce the severity of symptoms or prevent the infection from getting worse. Antifungal medication is typically given to people who are at higher risk for developing severe valley fever. The treatment typically occurs over a period of roughly 3 to 6 months. In some instances, longer treatment may be required. If valley fever develops into meningitis life-long antifungal treatment is typically necessary.

Scientists continue to study how weather and climate patterns affect the habitat of the fungus that causes valley fever. Coccidioides is thought to grow best in soil after heavy rainfall and then disperse into the air most effectively during hot, dry conditions. For example, hot and dry weather conditions have been shown to correlate with an increase in the number of valley fever cases in Arizona and in California. The ways in which climate change may be affecting the number of valley fever infections, as well as the geographic range of Coccidioides, isn't known yet, but is a subject for further research (CDC 2016).

REGULATORY FRAMEWORK

Air quality within the SJVAB is regulated by several jurisdictions including the U.S. EPA, ARB, and the SJVAPCD. Each of these jurisdictions develops rules, regulations, and policies to attain the goals or directives imposed upon them through legislation. Although U.S. EPA regulations may not be superseded, both state and local regulations may be more stringent.

FEDERAL

U.S. Environmental Protection Agency

At the federal level, the U.S. EPA has been charged with implementing national air quality programs. The U.S. EPA's air quality mandates are drawn primarily from the FCAA, which was signed into law in 1970. Congress substantially amended the FCAA in 1977 and again in 1990.

Federal Clean Air Act

The FCAA required the U.S. EPA to establish National Ambient Air Quality Standards (NAAQS), and also set deadlines for their attainment. Two types of NAAQS have been established: primary standards, which protect public health, and secondary standards, which protect public welfare from non-health-related adverse effects, such as visibility restrictions. NAAQS are summarized in Table 2.

The FCAA also required each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The FCAA Amendments of 1990 added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. The U.S. EPA has responsibility to review all state SIPs to determine conformance with the mandates of the FCAA, and the amendments thereof, and determine if implementation will achieve air quality goals. If the U.S. EPA determines a SIP to be inadequate, a Federal Implementation Plan (FIP) may be prepared for the nonattainment area that imposes additional control measures.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) first authorized the U.S. EPA to regulate asbestos in schools and Public and Commercial buildings under Title II of the law, which is also known as the Asbestos Hazard Emergency Response Act (AHERA). AHERA requires Local Education Agencies (LEAs) to inspect their schools for ACBM and prepare management plans to reduce the asbestos hazard. The Act also established a program for the training and accreditation of individuals performing certain types of asbestos work.

Asbestos School Hazard Abatement and Reauthorization Act

The Asbestos School Hazard Abatement and Reauthorization Act (ASHARA) reauthorized AHERA and made some minor changes in the Act. It also reauthorized the Asbestos School Hazard Abatement Act.

Asbestos School Hazard Abatement Act

The Asbestos School Hazard Abatement Act (ASHAA) of 1984 provided loans and grants to help financially needy public and private schools correct serious asbestos hazards. This program was funded from 1985 until 1993. There have been no funds appropriated since that date.

National Emission Standards for Hazardous Air Pollutants

Pursuant to the FCAA of 1970, the U.S. EPA established the National Emission Standards for Hazardous Air Pollutants. These are technology-based source-specific regulations that limit allowable emissions of HAPs.

Table 2. Summary of Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards	National Standards (Primary)
Ozone (O_3)	1-hour	0.09 ppm	–
	8-hour	0.070 ppm	0.070 ppm
Particulate Matter (PM_{10})	AAM	20 µg/m³	–
	24-hour	50 µg/m³	150 µg/m³
Fine Particulate Matter ($PM_{2.5}$)	AAM	12 µg/m³	12 µg/m³
	24-hour	No Standard	35 µg/m³
Carbon Monoxide (CO)	1-hour	20 ppm	35 ppm
	8-hour	9 ppm	9 ppm
	8-hour (Lake Tahoe)	6 ppm	–
Nitrogen Dioxide (NO_2)	AAM	0.030 ppm	53 ppb
	1-hour	0.18 ppm	100 ppb
Sulfur Dioxide (SO_2)	AAM	–	0.03 ppm
	24-hour	0.04 ppm	0.14 ppm
	3-hour	–	–
	1-hour	0.25 ppm	75 ppb
Lead	30-day Average	1.5 µg/m³	–
	Calendar Quarter	–	1.5 µg/m³
	Rolling 3-Month Average	–	0.15 µg/m³
Sulfates	24-hour	25 µg/m³	No Federal Standards
Hydrogen Sulfide	1-hour	0.03 ppm (42 µg/m³)	
Vinyl Chloride	24-hour	0.01 ppm (26 µg/m³)	
Visibility-Reducing Particle Matter	8-hour	Extinction coefficient: 0.23/kilometer-visibility of 10 miles or more (0.07-30 miles or more for Lake Tahoe) due to particles when the relative humidity is less than 70%.	

** For more information on standards visit: https://ww3.arb.ca.gov/research/aaqs/aaqs2.pdf*
Source: ARB 2020a

STATE

California Air Resources Board

The ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act of 1988. Other ARB duties include monitoring air quality (in conjunction with air monitoring networks maintained by air pollution control districts and air quality management districts, establishing California Ambient Air Quality Standards (CAAQS), which in many cases are more stringent than the NAAQS, and setting emissions standards for new motor vehicles. The CAAQS are summarized in Table 2. The emission standards established for motor vehicles differ depending on various factors including the model year, and the type of vehicle, fuel and engine used.

California Clean Air Act

The CCAA requires that all air districts in the state endeavor to achieve and maintain CAAQS for Ozone, CO, SO_2, and NO_2 by the earliest practical date. The CCAA specifies that districts focus particular attention on reducing the emissions from transportation and area-wide emission sources, and the act provides districts with authority to regulate indirect sources. Each district plan is required to either (1) achieve a five percent annual reduction, averaged over consecutive 3-year periods, in district-wide emissions of each non-attainment pollutant or its precursors, or (2) to provide for implementation of all feasible measures to reduce emissions. Any planning effort for air quality attainment would thus need to consider both state and federal planning requirements.

California Assembly Bill 170

Assembly Bill 170, Reyes (AB 170), was adopted by state lawmakers in 2003 creating Government Code Section 65302.1 which requires cities and counties in the San Joaquin Valley to amend their general plans to include data and analysis, comprehensive goals, policies and feasible implementation strategies designed to improve air quality.

Assembly Bills 1807 & 2588 - Toxic Air Contaminants

Within California, TACs are regulated primarily through AB 1807 (Tanner Air Toxics Act) and AB 2588 (Air Toxics Hot Spots Information and Assessment Act of 1987). The Tanner Air Toxics Act sets forth a formal procedure for ARB to designate substances as TACs. This includes research, public participation, and scientific peer review before ARB designates a substance as a TAC. Existing sources of TACs that are subject to the Air Toxics Hot Spots Information and Assessment Act are required to: (1) prepare a toxic emissions inventory; (2) prepare a risk assessment if emissions are significant; (3) notify the public of significant risk levels; and (4) prepare and implement risk reduction measures.

Regulations Related to Schools

The State of California has adopted various regulations and programs intended to reduce exposure of children to air pollutant concentrations, including the following:

Toxic Emissions Near Schools Program (AB 3205/SB 352)

Assembly Bill (AB) 3205 (Health and Safety Code Sections 42301.6–42301.9) addresses stationary sources of TACs near schools. It also requires public notice to the parents or guardians of children enrolled in any school located within one-quarter mile of the source and to each address within a 1,000-foot radius of a TAC source. Senate Bill (SB) 352 (Education Code Section 17213, Public Resources Code Section 21151.8) expands previous requirements to review sources of TACs near school sites. SB 352 directs school districts to include in the school site analysis any emissions sources, including, but not limited to, freeways and other busy traffic corridors, large agricultural operations, and rail yards within one-quarter mile of a school site. SB 352 requires that any school site located within 500 feet of the edge of the closest travel lane of a freeway or other busy traffic corridor be reviewed for potential health risks.

California Air Resources Board's Truck and Bus Regulation

This regulation requires fleets that operate in California to reduce diesel truck and bus emissions by retrofitting or replacing existing engines. Amendments were adopted in December 2010 to provide more time for fleets to comply. The amended regulation required installation of PM retrofits beginning January 1, 2012 and replacement of older trucks starting January 1, 2015. By January 1, 2023, nearly all vehicles would need to have 2010 model year engines or equivalent.

The regulation applies to nearly all privately and federally owned diesel fueled trucks and buses and privately and publicly owned school buses with a gross vehicle weight rating greater than 14,000 pounds. The regulation has provisions to provide extra credit for PM filters installed prior to July 2011, has delayed requirements for fleets with 3 or fewer vehicles, provisions for agricultural vehicles and other situations.

Lower-Emission School Bus Program 2007

Proposition 1B, which was approved by the voters on November 7th, 2006, enacts the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. This bond act authorizes $200 million for replacing and retrofitting school buses. The primary goal of the ARB's Lower-Emission School Bus Program is to reduce school children's exposure to both cancer-causing and smog-forming pollution. The program provides grant funding for new, safer school buses and to put air pollution control equipment (i.e., retrofit devices) on buses that are already on the road.

Airborne Toxic Control Measure to Limit School Bus Idling at Schools

ARB has approved an airborne toxic control measure (ATCM) that limits school bus idling and idling at or near schools to only when necessary for safety or operational concerns. The ATCM requires a driver of a school bus or vehicle, transit bus, or other commercial motor vehicle to manually turn off the bus or vehicle engine upon arriving at a school and to restart no more than 30 seconds before departing. A driver of a school bus or vehicle is subject to the same requirement when operating within 100 feet of a school and is prohibited from idling more than five minutes at each stop beyond schools, such as parking or maintenance facilities, school bus stops, or school activity destinations. A driver of a transit bus or other commercial motor vehicle is prohibited from idling more than five minutes at each stop within 100 feet of a school. Idling necessary for health, safety, or operational concerns is exempt from these restrictions. In addition, the ATCM requires a motor carrier of an affected bus or vehicle to ensure that drivers are informed of the idling requirements, track complaints and enforcement actions, and keep records of these driver education and tracking activities. This ATCM became effective in July 2003.

San Joaquin Valley Air Pollution Control District

The SJVAPCD is the agency primarily responsible for ensuring that NAAQS and CAAQS are not exceeded and that air quality conditions are maintained in the SJVAB, within which the proposed project is located. Responsibilities of the SJVAPCD include, but are not limited to, preparing plans for the attainment of ambient air quality standards, adopting and enforcing rules and regulations concerning sources of air pollution, issuing permits for stationary sources of air pollution, inspecting stationary sources of air pollution and responding to citizen complaints, monitoring ambient air quality and meteorological conditions, and implementing programs and regulations required by the FCAA and the CCAA. The SJVAPCD Rules and Regulations that are applicable to the proposed project include, but are not limited to, the following:

- *Regulation VIII (Fugitive Dust Prohibitions). Regulation VIII (Rules 8011-8081).* This regulation is a series of rules designed to reduce particulate emissions generated by human activity, including construction and demolition activities, carryout and trackout, paved and unpaved roads, bulk material handling and storage, unpaved vehicle/traffic areas, open space areas, etc.
- *Rule 4002 (National Emissions Standards for Hazardous Air Pollutants).* This rule may apply to projects in which portions of an existing building would be renovated, partially demolished or removed. With regard to asbestos, the NESHAP specifies work practices to be followed during renovation, demolition or other abatement activities when friable asbestos is involved. Prior to demolition activity, an asbestos survey of the existing structure may be required to identify the presence of any asbestos containing building materials (ACBM). Removal of identified ACBM must be removed by a certified asbestos contractor in accordance with CAL-OSHA requirements.
- *Rule 4102 (Nuisance).* Applies to any source operation that emits or may emit air contaminants or other materials.

- *Rule 4103 (Open Burning).* This rule regulates the use of open burning and specifies the types of materials that may be open burned. Section 5.1 of this rule prohibits the burning of trees and other vegetative (non-agricultural) material whenever the land is being developed for non-agricultural purposes.
- *Rule 4601 (Architectural Coatings).* Limits volatile organic compounds from architectural coatings.
- *Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations).* This rule applies to the manufacture and use of cutback, slow cure, and emulsified asphalt during paving and maintenance operations.
- *Rule 9510 (Indirect Source Review - ISR).* Requires developers of larger residential, commercial, recreational, and industrial projects to reduce smog-forming and particulate emissions from their projects' baselines. If project emissions still exceed the minimum baseline reductions, a project's developer will be required to mitigate the difference by paying an off-site fee to the District, which would then be used to fund clean-air projects. For projects subject to this rule, the ISR rule requires developers to mitigate and/or offset emissions sufficient to achieve: (1) 20-percent reduction of construction equipment exhaust NOx; (2) 45-percent reduction of construction equipment exhaust PM_{10}; (3) 33-percent reduction of operational NOx over 10 years; and (4) 50-percent reduction of operational PM_{10} over 10 years. SJVAPCD ISR applications must be filed "no later than applying for a final discretionary approval with a public agency."

REGULATORY ATTAINMENT DESIGNATIONS

Under the CCAA, ARB is required to designate areas of the state as attainment, nonattainment, or unclassified with respect to applicable standards. An "attainment" designation for an area signifies that pollutant concentrations did not violate the applicable standard in that area. A "nonattainment" designation indicates that a pollutant concentration violated the applicable standard at least once, excluding those occasions when a violation was caused by an exceptional event, as defined in the criteria. Depending on the frequency and severity of pollutants exceeding applicable standards, the nonattainment designation can be further classified as serious nonattainment, severe nonattainment, or extreme nonattainment, with extreme nonattainment being the most severe of the classifications. An "unclassified" designation signifies that the data does not support either an attainment or nonattainment designation. The CCAA divides districts into moderate, serious, and severe air pollution categories, with increasingly stringent control requirements mandated for each category.

The U.S. EPA designates areas for ozone, CO, and NO_2 as "does not meet the primary standards," "cannot be classified," or "better than national standards." For SO_2, areas are designated as "does not meet the primary standards," "does not meet the secondary standards," "cannot be classified," or "better than national standards." However, ARB terminology of attainment, nonattainment, and unclassified is more frequently used. The U.S. EPA uses the same sub-categories for nonattainment status: serious, severe, and extreme. In 1991, U.S. EPA assigned new nonattainment designations to areas that had previously been classified as Group I, II, or III for PM_{10} based on the likelihood that they would violate national PM_{10} standards. All other areas are designated "unclassified."

The state and national attainment status designations pertaining to the SJVAB are summarized in Table 3. The SJVAB is currently designated as a nonattainment area with respect to the state PM_{10} standard, ozone, and $PM_{2.5}$ standards. The SJVAB is designated nonattainment for the national 8-hour ozone and $PM_{2.5}$ standards. On September 25, 2008, the U.S. EPA redesignated the San Joaquin Valley to attainment for the PM_{10} NAAQS and approved the PM_{10} Maintenance Plan (SJVAPCD 2019).

AMBIENT AIR QUALITY

Air pollutant concentrations are measured at several monitoring stations in Merced County. The Merced-2334 M Street and the Merced-S Coffee Road monitoring stations are the closest representative monitoring sites to the proposed project site with sufficient data to meet U.S. EPA and/or ARB criteria for quality assurance. Ambient monitoring data was obtained for the last three years of available measurement data (i.e., 2016 through 2018) and are summarized in Table 4. As depicted, the state and national ozone, national $PM_{2.5}$, and state PM_{10} standards were exceeded on numerous occasions during the past 3 years.

Table 3. SJVAB Attainment Status Designations

Pollutant	National Designation	State Designation
Ozone, 1 hour	No Standard	Nonattainment/Severe
Ozone, 8 hour	Nonattainment/Extreme	Nonattainment
PM_{10}	Attainment	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
Carbon Monoxide	Attainment/Unclassified	Attainment/Unclassified
Nitrogen dioxide	Attainment/Unclassified	Attainment
Sulfur dioxide	Attainment/Unclassified	Attainment
Lead (particulate)	No Designation/Classification	Attainment
Hydrogen sulfide	No Federal Standard	Unclassified
Sulfates	No Federal Standard	Attainment
Visibility-reducing particulates	No Federal Standard	Unclassified
Vinyl Chloride	No Federal Standard	Attainment

For more information visit website url: https://www.valleyair.org/aqinfo/attainment.htm.

Source: SJVAPCD 2019

Table 4. Summary of Ambient Air Quality Monitoring Data[1]

	2016	2017	2018
Ozone			
Maximum concentration (1-hour/8-hour average)	0.097/0.086	0.093/0.084	0.104/0.083
Number of days state/national 1-hour standard exceeded	2/0	0/0	4/0
Number of days state/national 8-hour standard exceeded	29/28	17/16	23/21
Nitrogen Dioxide (NO_2)			
Maximum concentration (1-hour average)	35.4	38.9	45.8
Annual average	0	0	0
Number of days state/federal standard exceeded	0	0	0
Suspended Particulate Matter (PM_{10})			
Maximum concentration (state/national)	64.5/64.3	144.0/146.6	142.7/137.0
Number of days state standard exceeded (measured/calculated[2])	6/38.9	12/76.6	10/59.6
Number of days national standard exceeded (measured/calculated[2])	0/0	0/0	0/0
Suspended Particulate Matter ($PM_{2.5}$)			
Maximum concentration (state/national)	42.8	66.7	94.7
Annual Average (national)	11.1	12.6	14.2
Number of days national standard exceeded (measured/calculated[2])	2/6.3	6/20.4	10/29.7

ppm = parts per million by volume, µg/m³ = micrograms per cubic meter, NA=Not Available

1 *Ambient ozone, NO_2, data was obtained from the Merced-S Coffee Road Monitoring Station. PM_{10} and $PM_{2.5}$ data was obtained from the Merced-2334 M Street Monitoring Station.*

2 *Measured days are those days that an actual measurement was greater than the standard. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day.*

Source: ARB 2020b

Sensitive Receptors

One of the most important reasons for air quality standards is the protection of those members of the population who are most sensitive to the adverse health effects of air pollution, termed "sensitive receptors." The term sensitive receptors refer to specific population groups, as well as the land uses where individuals would reside for long periods. Commonly identified sensitive population groups are children, the elderly, the acutely ill, and the chronically ill. Commonly identified sensitive land uses would include facilities that house or attract children, the elderly, people with illnesses, or others who are especially sensitive to the effects of air pollutants. Residential dwellings, schools, parks, playgrounds, childcare centers, convalescent homes, and hospitals are examples of sensitive land uses.

Sensitive land uses located in the vicinity of the proposed project site consist predominantly of residential land uses. The nearest residential dwellings are located adjacent to and west of the project site, along Sierra Madre Drive. Residential uses are also located to the east of the project site, across Bridgewater Street, and to the south of the project site, across Juniper Avenue. Nearby residential land uses are depicted in Figure 1.

Impacts & Mitigation Measures

Methodology

Short-term Impacts

Short-term construction emissions associated with the proposed project were calculated using the CalEEMod computer program. Emissions were quantified for site preparation, grading, asphalt paving, facility construction, and application of architectural coatings. Detailed construction information, including construction schedules and equipment requirements, have not yet been identified for the proposed project. Default construction phases, vehicle trips, and equipment usage assumptions contained in the CalEEMod model were, therefore, relied upon for the calculation of construction-generated emissions. Modeling assumptions and output files are included in Appendix A of this report.

Long-term Impacts

Long-term operational emissions of criteria air pollutants associated with the proposed project were calculated using the CalEEMod computer program. Modeling was conducted based on traffic data derived, in part, from the traffic analysis prepared for the proposed project (JLB 2020). Mobile-source emissions were conservatively based on the default fleet distribution assumptions contained in the model. All other modeling assumptions were based on the default parameters contained in the CalEEMod computer model. Modeling assumptions and output files are included in Appendix A of this report. Localized air quality impacts, including toxic air contaminants, fugitive dust, mobile-source CO, and odors were qualitatively assessed.

Thresholds of Significance

In accordance with Appendix G of the CEQA Guidelines Initial Study Checklist, a project would be considered to have a significant impact to climate change if it would:

a) Conflict with or obstruct implementation of the applicable air quality plan.

b) 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.

c) Expose sensitive receptors to substantial pollutant concentrations.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.

To assist local jurisdictions in the evaluation of air quality impacts, the SJVAPCD has published the Guide for Assessing and Mitigating Air Quality Impacts (SJVAPCD 2015). This guidance document includes recommended thresholds of significance to be used for the evaluation of short-term construction, long-term operational, odor, toxic air contaminant, and cumulative air quality impacts. Accordingly, the SJVAPCD-recommended thresholds of significance are used to determine whether implementation of the proposed project would result in a significant air quality impact. The thresholds of significance are summarized below.

- Short-term Emissions—Construction impacts associated with the proposed project would be considered significant if project-generated emissions would exceed 100 tons per year (TPY) of CO, 10 TPY of ROG or NO_X, 27 TPY of SO_X, or 15 TPY of PM_{10} or $PM_{2.5}$.
- Long-term Emissions—Operational impacts associated with the proposed project would be considered significant if project generated emissions would exceed 100 TPY of CO, 10 TPY of ROG or NO_X, 27 TPY of SO_X, or 15 TPY of PM_{10} or $PM_{2.5}$.
- Conflict with or Obstruct Implementation of Applicable Air Quality Plan—Due to the region's non-attainment status for ozone, $PM_{2.5}$, and PM_{10}, if project-generated emissions of ozone precursor pollutants (i.e., ROG and NO_x) or PM would exceed the SJVAPCD's significance thresholds, then the project would be considered to conflict with the attainment plans.
- Local Mobile-Source CO Concentrations—Local mobile source impacts associated with the proposed project would be considered significant if the project contributes to CO concentrations at receptor locations in excess of the CAAQS (i.e., 9.0 ppm for 8 hours or 20 ppm for 1 hour).
- Exposure to toxic air contaminants (TAC) would be considered significant if the probability of contracting cancer for the Maximally Exposed Individual (i.e., maximum individual risk) would exceed 20 in 1 million or would result in a Hazard Index greater than 1.
- Odor impacts associated with the proposed project would be considered significant if the project has the potential to frequently expose members of the public to objectionable odors.

In addition to the above thresholds, the SJVAPCD also recommends the use of average-daily emissions thresholds for the evaluation of project impacts on localized ambient air quality conditions. Accordingly, the proposed project would also be considered to result in a significant contribution to localized ambient air quality if on-site emissions or ROG, NO_X, PM_{10}, $PM_{2.5}$, CO, or SO_2 associated with either short-term construction or long-term operational activities would exceed a daily average of 100 pounds per day (lbs/day) for each of the pollutants evaluated (SJVAPCD 2015). It is important to note that the SJVAPCD's recommended thresholds of significance were developed taking into account the achievement and maintenance of applicable ambient air quality standards (refer to Table 1). As previously noted, these standards represent the upper limits deemed necessary to adequately protect public health and welfare. Potential health-related impacts for criteria air pollutants are discussed earlier in this report and summarized in Table 2. Therefore, project's that do not exceed SJVAPCD's recommended significance thresholds would also be considered to have a less-than-significant impact with regard to potential health-related impacts.

PROJECT IMPACTS

Impact AQ-A. Would the project conflict with or obstruct implementation of the applicable air quality plan?

In accordance with SJVAPCD-recommended methodology for the assessment of air quality impacts, projects that result in significant air quality impacts at the project level are also considered to have a significant cumulative air quality impact. As noted in Impact AQ-B, short-term construction and long-term operational emissions would not exceed applicable thresholds. In addition, the proposed project's contribution to localized concentrations of emissions, including emissions of CO, TACs, and odors, are considered less than significant. However, as noted in Impact AQ-C, the proposed project could result in a significant contribution to localized PM concentrations for which the SJVAB is currently designated nonattainment. For this reason, implementation of the proposed project could conflict with air quality attainment or maintenance planning efforts. This impact would be considered ***potentially significant***.

Mitigation Measure: Implement Mitigation Measure AQ-1 (refer to Impact AQ-C).

Significance after Mitigation: With implementation of Mitigation Measure AQ-1 this impact would be considered less than significant.

Impact AQ-B. Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?

The proposed project is in the County of Merced, which is within the SJVAB. The SJVAB is designated nonattainment for the national 8-hour ozone and $PM_{2.5}$ standards. On September 25, 2008, the U.S. EPA redesignated the San Joaquin Valley to attainment for the PM_{10} NAAQS and approved the PM_{10} Maintenance Plan (SJVAPCD 2019). Potential air quality impacts associated with the proposed project could potentially occur during project construction or operational phases. Short-term construction and long-term air quality impacts associated with the proposed project are discussed, as follows:

Short-term Construction Emissions

Short-term increases in emissions would occur during the construction process. Construction-generated emissions are of temporary duration, lasting only as long as construction activities occur, but have the potential to represent a significant air quality impact. The construction of the proposed project would result in the temporary generation of emissions associated with site grading and excavation, paving, motor vehicle exhaust associated with construction equipment, and worker trips; as well as, the movement of construction equipment on unpaved surfaces. Short-term construction emissions would result in increased emissions of ozone-precursor pollutants (i.e., ROG and NO_X) and emissions of PM. Emissions of ozone-precursors would result from the operation of on-road and off-road motorized vehicles and equipment. Emissions of airborne PM are largely dependent on the amount of ground disturbance associated with site grading and excavation activities and can result in increased concentrations of PM that can adversely affect nearby sensitive land uses. Estimated construction-generated annual emissions associated with the proposed project are summarized in Table 5.

Table 5. Annual Construction Emissions

Construction Phase	Uncontrolled Maximum Annual Emissions (TPY) [1]					
	ROG	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$
Site Preparation	0.0	0.02	0.02	0.0	0.0	0.0
Grading	0.01	0.05	0.03	0.0	0.02	0.01
Building Construction	0.20	1.60	1.60	0.00	0.08	0.07
Paving	0.01	0.05	0.06	0.00	0.00	0.00
Architectural Coating	0.40	0.10	0.10	0.00	0.01	0.01
Total:	0.6	1.8	1.8	<0.1	0.1	0.1
Significance Thresholds:	*10*	*10*	*None*	*None*	*15*	*15*
Exceeds Thresholds/Significant Impact?:	*No*	*No*	*No*	*No*	*No*	*No*

1. Based on CalEEMod computer modeling. Does not include emission control measures. To be conservative, assumes all construction activities would occur over a 12-month period. Totals may not sum due to rounding.
Refer to Appendix A for modeling results and assumptions.

As noted in Table 5, construction of the proposed project would generate maximum uncontrolled annual emissions of approximately 0.6 tons/year of ROG, 1.8 tons/year of NO_x, 1.8 tons/year of CO, and approximately 0.1 tons/year of PM_{10}, and $PM_{2.5}$. Emissions of SO_X would be negligible, less than 0.1 tons/year. Estimated construction-generated emissions would not exceed the SJVAPCD's significance thresholds of 10 tons/year of ROG, 10 tons/year of NO_x, or 15 tons/year PM_{10}.

Estimated average-daily on-site construction emissions are summarized in Table 6. To be conservative, maximum average-daily emissions assume that building construction, paving, and architectural coatings could potentially occur on the same day. As noted in Table 6, construction of the proposed project would generate maximum uncontrolled average-daily on-site emissions of approximately 9.1 lbs/day of ROG, 26.1 lbs/day of NO_x, 28.1 lbs/day of CO, 6.7 lbs/day of PM_{10}, and 3.3 lbs/day of $PM_{2.5}$. Emissions of SO_2 would be negligible (e.g., less than 0.1 tons/year). Average-daily on-site construction emissions would not exceed the SJVAPCD's recommended localized ambient air quality significance thresholds of 100 lbs/day for each of the criteria air pollutants evaluated.

Table 6. Average-Daily On-Site Construction Emissions

Construction Phase	Uncontrolled Daily Emissions (lbs/day) [1]					
	ROG	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$
Site Preparation	1.3	13.3	13.3	<0.1	2.0	0.7
Grading	1.7	16.7	10.0	<0.1	6.7	3.3
Building Construction	1.8	14.6	14.6	<0.1	0.7	0.6
Paving	1.4	10.0	12.0	<0.1	0.4	0.4
Architectural Coating	5.9	1.5	1.5	<0.1	0.1	0.1
Maximum Average-Daily On-site Emissions:	9.1	26.1	28.1	<0.1	6.7	3.3
Significance Thresholds:	*100*	*100*	*100*	*100*	*100*	*100*
Exceeds Thresholds/Significant Impact?:	*No*	*No*	*No*	*No*	*No*	*No*

1. Based on CalEEMod computer modeling. Totals may not sum due to rounding. Does not include emission control measures, including dust control per Regulation VIII.
2. Average daily on-site emissions are based on total on-site emissions divided by the total number of construction days.
3. Maximum daily on-site emissions assumes building construction, paving, and architectural coating application could potentially occur simultaneously.
Refer to Appendix A for modeling results and assumptions.

Short-term construction of the proposed project would not result in a significant impact to regional or local air quality conditions. Furthermore, it is important to note that project construction is not anticipated to require extensive grading and would be required to comply with SJVPACD Regulation VIII (Fugitive PM_{10} Prohibitions). Mandatory compliance with SJVAPCD Regulation VIII would further reduce emissions of fugitive dust from the project site and minimize the project's potential to adversely affect nearby sensitive receptors. With compliance with SJVAPCD Regulation VIII, emissions of fugitive PM would be reduced by approximately 50 percent, or more. Given that project-generated emissions would not exceed applicable SJVAPCD significance thresholds, short-term construction activities would not be projected to violate or contribute substantially to existing or projected non-attainment conditions or associated adverse health impacts. This impact would be considered ***less than significant***.

<u>Long-term Operational Emissions</u>

Estimated annual operational emissions for the proposed project are summarized in Table 7. As depicted, the proposed project would result in operational emissions of approximately 0.5 tons/year of ROG, 2.9 tons/year of NO_X, 2.4 tons/year of CO, 0.7 tons/year of PM_{10}, and 0.2 tons/year of $PM_{2.5}$ during the initial year of operation. Emissions of SO_2 would be negligible (i.e., less than 0.1 tons/year). Operational emissions would be projected to decline in future years, with improvements in fuel-consumption emissions standards. Operational emissions would not exceed SJVAPCD's annual mass-emissions significance thresholds.

Estimated average-daily on-site operational emissions are also summarized in Table 7. Average-daily on-site operational emissions would be largely associated with area sources (e.g., landscape maintenance activities and use of consumer products) and the use of natural-gas fired appliances. Average-daily on-site emissions would total approximately 1.8 lbs/day of ROG, 0.5 lbs/day of NO_X, and 0.4 lbs/day of CO. Average-daily on-site emissions of other pollutants would be negligible (i.e., less than 0.1 lbs/day). Average-daily on-site emissions would not exceed the SJVAPCD's recommended localized ambient air quality significance thresholds of 100 lbs/day for each of the criteria air pollutants evaluated.

Table 7. Long-term Operational Emissions (Unmitigated)

Season	Uncontrolled Annual Emissions (tons/year)[1]					
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
Area Source	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Energy Use	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mobile Source[2]	0.3	2.9	2.4	<0.1	0.7	0.2
Total:	0.5	2.9	2.4	<0.1	0.7	0.2
Significance Thresholds (tons):	*10*	*10*	*None*	*None*	*15*	*None*
Exceeds Thresholds/Significant Impact?:	*No*	*No*	--	--	*No*	--
Average Daily On-site Emissions (lbs)[3]:	*1.8*	*0.5*	*0.4*	*Negligible*		
Significance Thresholds (lbs):	*100*	*100*	*100*	*100*	*100*	*100*
Exceeds Thresholds/Significant Impact?:	*No*	*No*	*No*	*No*	*No*	*No*

1. *Emissions were calculated using the CalEEMod computer program. Does not include implementation of emissions control measures.*
2. *Fleet distribution data for the project is not available. Mobile source emissions are conservatively based on default vehicle fleet distribution for Merced County, which includes all vehicle types/classifications, including medium and heavy-duty vehicles. Actual emissions would likely be lower.*
3. *Based on calculated annual operational emissions from area sources and an average of 260 operational days annually. Negligible emissions are less than 0.1 lbs/day.*

Totals may not sum due to rounding.
Refer to Appendix A for modeling assumptions and results.

Long-term operation of the proposed project would not result in a significant impact to regional or local air quality conditions. It is important to note that estimated operational emissions are conservatively based on the default vehicle fleet distribution assumptions contained in the model, which include contributions from medium and heavy-duty trucks. Mobile sources associated with schools typically consist largely to light-duty vehicles and buses. As a result, actual mobile-source emissions would likely be less than estimated. Given that project-generated emissions would not exceed applicable SJVAPCD significance thresholds, long-term operational activities would not be projected to violate or contribute substantially to existing or projected non-attainment conditions or associated adverse health impacts. This impact would be considered ***less than significant***.

Impact AQ-C. Would the project expose sensitive receptors to substantial pollutant concentrations?

Sensitive land uses located in the vicinity of the proposed project site consist predominantly of residential land uses. The nearest residential land uses are located adjacent to the western boundary of the project site. Residential land uses are also located to the south and east of the project site (refer to Figure 1). Long-term operational and short-term construction activities and emission sources that could adversely impact these nearest sensitive receptors are discussed, as follows:

Long-term Operation

Localized Mobile-Source CO Emissions

Carbon monoxide is the primary criteria air pollutant of local concern associated with the proposed project. Under specific meteorological and operational conditions, such as near areas of heavily congested vehicle traffic, CO concentrations may reach unhealthy levels. If inhaled, CO can be adsorbed easily by the blood stream and can inhibit oxygen delivery to the body, which can cause significant health effects ranging from slight headaches to death. The most serious effects are felt by individuals susceptible to oxygen deficiencies, including people with anemia and those suffering from chronic lung or heart disease.

Mobile-source emissions of CO are a direct function of traffic volume, speed, and delay. Transport of CO is extremely limited because it disperses rapidly with distance from the source under normal meteorological conditions. For this reason, modeling of mobile-source CO concentrations is typically recommended for sensitive land uses located near signalized roadway intersections that are projected to operate at unacceptable levels of service (i.e., LOS E or F). Localized CO concentrations associated with the proposed project would be considered less-than-significant impact if: (1) traffic generated by the proposed project would not result in deterioration of a signalized intersection to a LOS of E or F; or (2) the project would not contribute additional traffic to a signalized intersection that already operates at LOS of E or F.

No signalized intersections are located in the project area that would be significantly affected by project implementation. With implementation of the proposed traffic improvements, the intersection of Bridgewater Street and Juniper Avenue would be signalized and would be projected to operate at LOS A under future cumulative conditions (JBL 2020). In comparison to the CO screening criteria, implementation of the proposed project would not result in or contribute to unacceptable levels of service (i.e., LOS E, or worse) at nearby signalized intersections. As a result, the proposed project would not be anticipated to contribute substantially to localized CO concentrations that would exceed applicable standards. For this reason, this impact would be considered ***less than significant***.

Short-term Construction

Naturally Occurring Asbestos

Naturally-occurring asbestos, which was identified by ARB as a TAC in 1986, is located in many parts of California and is commonly associated with ultramafic rock. The project site is not located near any areas that are likely to contain ultramafic rock (DOC 2000). As a result, risk of exposure to asbestos during the construction process would be considered ***less than significant***.

Diesel-Exhaust Emissions

Implementation of the proposed project would result in the generation of DPM emissions during construction associated with the use of off-road diesel equipment for site preparation, grading, paving, and building construction activities. Health-related risks associated with diesel-exhaust emissions are primarily associated with long-term exposure and associated risk of contracting cancer. For residential land uses, the calculation of cancer risk associated with exposure of to TACs are typically calculated based on a 25 to 30-year period of exposure. The use of diesel-powered construction equipment, however, would be temporary and episodic and would occur over a relatively large area. Assuming that construction activities involving the use of diesel-fueled equipment would occur over an approximate 12-month period, project-related construction activities would constitute less than four percent of the typical exposure period. It is also important to note that the use of heavy-duty diesel-fueled equipment (e.g., graders, scrapers) would be largely limited to the initial site preparation, grading, and paving phases. Based on the CalEEMod construction phasing assumptions, site preparation and grading activities are estimated to occur over an approximate two-week period. Paving activities would, likewise, be estimated to occur over an approximate two-week period. Other construction activities, such as building foundation work, would involve the intermittent use of smaller diesel-fueled equipment (e.g., backhoes, front-end loaders, forklifts).

However, construction of the proposed project would not involve the intensive use of heavy-duty equipment over an extended period of time (e.g., years). For these reasons, exposure to construction-generated DPM would not be anticipated to exceed applicable thresholds (i.e., incremental increase in cancer risk of 20 in one million). In addition, implementation of Mitigation Measure AQ-1 would result in further reductions of on-site DPM emissions. This impact would be considered ***less than significant***.

Localized PM Concentrations

Project construction would also result in short-term increases of fugitive dust associated predominantly with site preparation, grading, material handling, and vehicle travel on unpaved and paved surfaces. On-site off-road equipment and trucks would also result in short-term emissions of diesel-exhaust PM, which could contribute to elevated localized concentration at nearby receptors. Uncontrolled emissions of fugitive dust may also contribute to increased occurrences of Valley Fever and potential increases in nuisance impacts to nearby receptors. For these reasons, localized uncontrolled concentrations of construction-generated PM, particularly activities not specifically addressed in the RAW, would be considered to have a ***potentially-significant*** impact.

Mitigation Measure AQ-1: The following measures shall be implemented to reduce potential expose of nearby sensitive receptors to localized concentrations of construction-generated PM:

1. On-road diesel vehicles shall comply with Section 2485 of Title 13 of the California Code of Regulations. This regulation limits idling from diesel-fueled commercial motor vehicles with gross vehicular weight ratings of more than 10,000 pounds and licensed for operation on highways. It applies to California and non-California based vehicles. In general, the regulation specifies that drivers of said vehicles:
    a. Shall not idle the vehicle's primary diesel engine for greater than 5 minutes at any location, except as noted in Subsection (d) of the regulation; and,
    b. Shall not operate a diesel-fueled auxiliary power system to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than 5.0 minutes at any location when within 1,000 feet of a restricted area, except as noted in Subsection (d) of the regulation.
2. Off-road diesel equipment shall comply with the 5 minute idling restriction identified in Section 2449(d)(2) of the California Air Resources Board's In-Use off-Road Diesel regulation. The specific requirements and exceptions in the regulations can be reviewed at the following web sites: www.arb.ca.gov/msprog/truck-idling/2485.pdf and ww.arb.ca.gov/regact/2007/ordiesl07/frooal.pdf.
3. Signs shall be posted at the project site construction entrance to remind drivers and operators of the state's 5-minute idling limit.
4. To the extent available, replace fossil-fueled equipment with alternatively-fueled (e.g., natural gas) or electrically-driven equivalents.
5. Construction truck trips shall be scheduled, to the extent feasible, to occur during non-peak hours and truck haul routes shall be selected to minimize impacts to nearby residential dwellings.
6. The burning of vegetative material shall be prohibited.
7. The proposed project shall comply with SJVAPCD Regulation VIII for the control of fugitive dust emissions. Regulation VIII can be obtained on the SJVAPCD's website at website URL: https://www.valleyair.org/rules/1ruleslist.htm. At a minimum, the following measures shall be implemented:
    a. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover.
    b. All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.

c. All land clearing, grubbing, scraping, excavation, land leveling, grading, cut & fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.

d. With the demolition of buildings up to six stories in height, all exterior surfaces of the building shall be wetted during demolition.

e. When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained.

f. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions.) (Use of blower devices is expressly forbidden.)

g. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant.

h. On-road vehicle speeds on unpaved surfaces of the project site shall be limited to 15 mph.

i. Sandbags or other erosion control measures shall be installed sufficient to prevent silt runoff to public roadways from sites with a slope greater than one percent.

j. Excavation and grading activities shall be suspended when winds exceed 20 mph (Regardless of wind speed, an owner/operator must comply with Regulation VIII's 20 percent opacity limitation).

8. The above measures for the control of construction-generated emissions shall be included on site grading and construction plans.

Impact AQ-D. Would the project result in other emissions (such as those leading to odors) affecting a substantial number of people?

Other emissions potentially associated with the proposed project would be predominantly associated to the generation of odors during project construction. The occurrence and severity of odor impacts depends on numerous factors, including: the nature, frequency, and intensity of the source; wind speed and direction; and the sensitivity of the receptors. While offensive odors rarely cause any physical harm, they still can be very unpleasant, leading to considerable distress among the public and often generating citizen complaints to local governments and regulatory agencies.

Construction of the proposed project would involve the use of a variety of gasoline or diesel-powered equipment that would emit exhaust fumes. Exhaust fumes, particularly diesel-exhaust, may be considered objectionable by some people. In addition, pavement coatings and architectural coatings used during project construction would also emit temporary odors. However, construction-generated emissions would occur intermittently throughout the workday and would dissipate rapidly within increasing distance from the source. As a result, short-term construction activities would not expose a substantial number of people to frequent odorous emissions. In addition, no major sources of odors have been identified in the project area. This impact would be considered ***less than significant***.

GREENHOUSE GASES AND CLIMATE CHANGE

EXISTING SETTING

To fully understand global climate change, it is important to recognize the naturally occurring "greenhouse effect" and to define the greenhouse gases (GHGs) that contribute to this phenomenon. Various gases in the earth's atmosphere, classified as atmospheric GHGs, play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space and a portion of the radiation is absorbed by the earth's surface. The earth emits this radiation back toward space, but the properties of the radiation change from high-frequency solar radiation to lower-frequency infrared radiation. Greenhouse gases, which are transparent to solar radiation, are effective in absorbing infrared radiation. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This phenomenon is known as the greenhouse effect. Among the prominent GHGs contributing to the greenhouse effect are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Primary GHGs attributed to global climate change, are discussed, as follows:

- **Carbon Dioxide**. Carbon dioxide (CO_2) is a colorless, odorless gas. CO_2 is emitted in a number of ways, both naturally and through human activities. The largest source of CO_2 emissions globally is the combustion of fossil fuels such as coal, oil, and gas in power plants, automobiles, industrial facilities, and other sources. A number of specialized industrial production processes and product uses such as mineral production, metal production, and the use of petroleum-based products can also lead to CO_2 emissions. The atmospheric lifetime of CO_2 is variable because it is so readily exchanged in the atmosphere (U.S. EPA 2018).

- **Methane**. Methane (CH_4) is a colorless, odorless gas that is not flammable under most circumstances. CH_4 is the major component of natural gas, about 87 percent by volume. It is also formed and released to the atmosphere by biological processes occurring in anaerobic environments. Methane is emitted from a variety of both human-related and natural sources. Human-related sources include fossil fuel production, animal husbandry (enteric fermentation in livestock and manure management), rice cultivation, biomass burning, and waste management. These activities release significant quantities of methane to the atmosphere. Natural sources of methane include wetlands, gas hydrates, permafrost, termites, oceans, freshwater bodies, non-wetland soils, and other sources such as wildfires. Methane's atmospheric lifetime is about 12 years (U.S. EPA 2018).

- **Nitrous Oxide**. Nitrous oxide (N_2O) is a clear, colorless gas with a slightly sweet odor. N_2O is produced by both natural and human-related sources. Primary human-related sources of N_2O are agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuels, acid production, and nitric acid production. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. The atmospheric lifetime of N_2O is approximately 114 years (U.S. EPA 2018).

- **Hydrofluorocarbons.** Hydrofluorocarbons (HFCs) are man-made chemicals, many of which have been developed as alternatives to ozone-depleting substances for industrial, commercial, and consumer products. The only significant emissions of HFCs before 1990 were of the chemical HFC-23, which is generated as a byproduct of the production of HCFC-22 (or Freon 22, used in air conditioning applications). The atmospheric lifetime for HFCs varies from just over a year for HFC-152a to 270 years for HFC-23. Most of the commercially used HFCs have atmospheric lifetimes of less than 15 years (e.g., HFC-134a, which is used in automobile air conditioning and refrigeration, has an atmospheric life of 14 years) (U.S. EPA 2018).

- **Perfluorocarbons.** Perfluorocarbons (PFCs) are colorless, highly dense, chemically inert, and nontoxic. There are seven PFC gases: perfluoromethane (CF_4), perfluoroethane (C_2F_6), perfluoropropane (C_3F_8), perfluorobutane (C_4F_{10}), perfluorocyclobutane (C_4F_8), perfluoropentane (C_5F_{12}), and perfluorohexane (C_6F_{14}). Natural geological emissions have been responsible for the PFCs that have accumulated in the atmosphere in the past; however, the largest current source is aluminum production, which releases CF_4 and C_2F_6 as byproducts. The estimated atmospheric lifetimes for PFCs ranges from 2,600 to 50,000 years (U.S. EPA 2018).

- **Nitrogen Trifluoride**. Nitrogen trifluoride (NF_3) is an inorganic, colorless, odorless, toxic, nonflammable gas used as an etchant in microelectronics. Nitrogen trifluoride is predominantly employed in the cleaning of the plasma-enhanced chemical vapor deposition chambers in the production of liquid crystal displays and silicon-based thin film solar cells. It has a global warming potential of 16,100 carbon dioxide equivalents (CO_2e). While NF_3 may have a lower global warming potential than other chemical etchants, it is still a potent GHG. In 2009, NF_3 was listed by California as a high global warming potential GHG to be listed and regulated under Assembly Bill (AB) 32 (Section 38505 Health and Safety Code).

- **Sulfur Hexafluoride**. Sulfur hexafluoride (SF_6) is an inorganic compound that is colorless, odorless, nontoxic, and generally nonflammable. SF_6 is primarily used as an electrical insulator in high voltage equipment. The electric power industry uses roughly 80 percent of all SF_6 produced worldwide. Leaks of SF_6 occur from aging equipment and during equipment maintenance and servicing. SF_6 has an atmospheric life of 3,200 years (U.S. EPA 2018).

- **Black Carbon**. Black carbon is the strongest light-absorbing component of particulate matter (PM) emitted from burning fuels such as coal, diesel, and biomass. Black carbon contributes to climate change both directly by absorbing sunlight and indirectly by depositing on snow and by interacting with clouds and affecting cloud formation. Black carbon is considered a short-lived species, which can vary spatially and, consequently, it is very difficult to quantify associated global-warming potentials. The main sources of black carbon in California are wildfires, off-road vehicles (locomotives, marine vessels, tractors, excavators, dozers, etc.), on-road vehicles (cars, trucks, and buses), fireplaces, agricultural waste burning, and prescribed burning (planned burns of forest or wildlands) (ARB 2017, U.S. EPA 2018).

Each GHG differs in its ability to absorb heat in the atmosphere based on the lifetime, or persistence, of the gas molecule in the atmosphere. Often, estimates of GHG emissions are presented in CO_2e, which weight each gas by its global warming potential (GWP). Expressing GHG emissions in CO_2e takes the contribution of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted. Table 8 provides a summary of the GWP for GHG emissions of typical concern with regard to community development projects, based on a 100-year time horizon. As indicated, Methane traps over 25 times more heat per molecule than CO_2, and N_2O absorbs roughly 298 times more heat per molecule than CO_2. Additional GHG with high GWP include Nitrogen trifluoride, Sulfur hexafluoride, Perfluorocarbons, and black carbon.

Table 8. Global Warming Potential for Greenhouse Gases

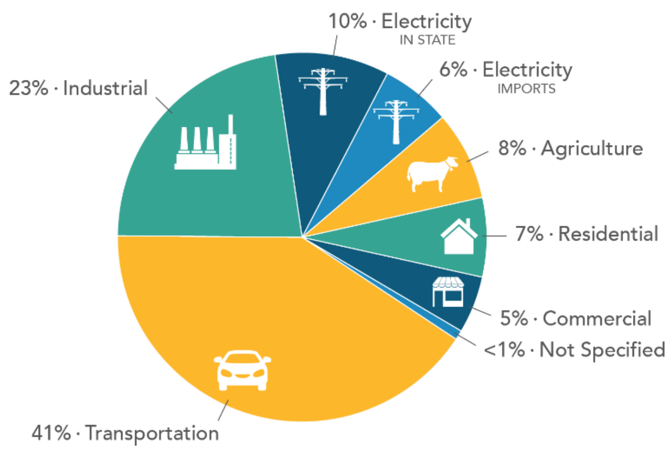
Greenhouse Gas	Global Warming Potential (100-year)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous Dioxide (N_2O)	298
**Based on IPCC GWP values for 100-year time horizon* *Source: IPCC 2007*	

SOURCES OF GHG EMISSIONS

On a global scale, GHG emissions are predominantly associated with activities related to energy production; changes in land use, such as deforestation and land clearing; industrial sources; agricultural activities; transportation; waste and wastewater generation; and commercial and residential land uses. World-wide, energy production including the burning of coal, natural gas, and oil for electricity and heat are typically considered the largest single sources of global GHG emissions.

In 2016, GHG emissions within California totaled 429.4 million metric tons of carbon dioxide equivalents ($MMTCO_2e$). Within California, the transportation sector is the largest contributor, accounting for roughly 41 percent of the total state-wide GHG emissions. Emissions associated with the industrial sector are the second largest contributor, totaling approximately 23 percent. Emissions from in-state electricity generation, imported electricity, agriculture, residential, and commercial uses constitute the remaining major sources on GHG emissions. In comparison to the year 2014 emissions inventory, overall GHG emissions in California decreased by 12 MMTCO2e. The State of California GHG emissions inventory for year 2016, by main economic sector, is depicted in Figure 3 (ARB 2020c).

Figure 3. State of California Greenhouse Gases Emissions Inventory by Sector



Emissions inventory is categorized based on main economic sector. "Not Specified" includes sources that could not be attributed to an individual sector, such as evaporative losses and emissions from use of ozone-depleting substances. Source: ARB 2020c

Short-Lived Climate Pollutants

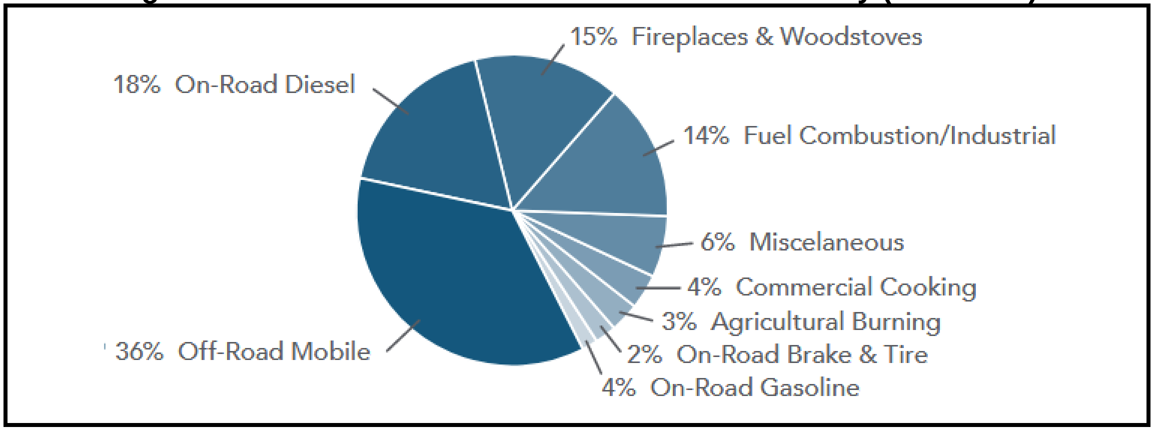
Short-lived climate pollutants (SLCPs), such as black carbon, fluorinated gases, and methane also have a dramatic effect on climate change. Though short lived, these pollutants create a warming influence on the climate that is many times more potent than that of carbon dioxide.

As part of the ARB's efforts to address SLCPs, the ARB has developed a statewide emission inventory for black carbon. The black carbon inventory will help support implementation of the SLCP Strategy, but it is not part of the State's GHG Inventory that tracks progress towards the State's climate targets. The most recent inventory for year 2013 conditions is depicted in Figure 4. As depicted, off-road mobile sources account for a majority of black carbon emissions totaling roughly 36 percent of the inventory. Other major anthropogenic sources of black carbon include on-road transportation, residential wood burning, fuel combustion, and industrial processes (ARB 2017).

EFFECTS OF GLOBAL CLIMATE CHANGE

There are uncertainties as to exactly what the climate changes will be in various local areas of the earth. There are also uncertainties associated with the magnitude and timing of other consequences of a warmer planet: sea level rise, spread of certain diseases out of their usual geographic range, the effect on agricultural production, water supply, sustainability of ecosystems, increased strength and frequency of storms, extreme heat events, increased air pollution episodes, and the consequence of these effects on the economy.

Figure 4. California Black Carbon Emissions Inventory (Year 2013)



Source: ARB 2017

Within California, climate changes would likely alter the ecological characteristics of many ecosystems throughout the state. Such alterations would likely include increases in surface temperatures and changes in the form, timing, and intensity of precipitation. For instance, historical records are depicting an increasing trend toward earlier snowmelt in the Sierra Nevada. This snowpack is a principal supply of water for the state, providing roughly 50 percent of state's annual runoff. If this trend continues, some areas of the state may experience an increased danger of floods during the winter months and possible exhaustion of the snowpack during spring and summer months. An earlier snowmelt would also impact the State's energy resources. Currently, approximately 20 percent of California's electricity comes from hydropower. An early exhaustion of the Sierra snowpack, may force electricity producers to switch to more costly or non-renewable forms of electricity generation during spring and summer months. A changing climate may also impact agricultural crop yields, coastal structures, and biodiversity. As a result, resultant changes in climate will likely have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing, and forestry (ARB 2017).

REGULATORY FRAMEWORK

FEDERAL

Executive Order 13514

Executive Order 13514 is focused on reducing GHGs internally in federal agency missions, programs, and operations. In addition, the executive order directs federal agencies to participate in the Interagency Climate Change Adaptation Task Force, which is engaged in developing a national strategy for adaptation to climate change.

On April 2, 2007, in Massachusetts v. U.S. EPA, 549 U.S. 497 (2007), the Supreme Court found that GHGs are air pollutants covered by the FCAA and that the U.S. EPA has the authority to regulate GHG. The Court held that the U.S. EPA Administrator must determine whether or not emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision.

On December 7, 2009, the U.S. EPA Administrator signed two distinct findings regarding GHGs under section 202(a) of the Clean Air Act:

- Endangerment Finding: The Administrator found that the current and projected concentrations of the six key well-mixed GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) in the atmosphere threaten the public health and welfare of current and future generations.

- Cause or Contribute Finding: The Administrator found that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

Although these findings did not themselves impose any requirements on industry or other entities, this action was a prerequisite to finalizing the U.S. EPA's Proposed Greenhouse Gas Emission Standards for Light-Duty Vehicles, which was published on September 15, 2009. On May 7, 2010 the final Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards was published in the Federal Register.

U.S. EPA and the National Highway Traffic Safety Administration (NHTSA) are taking coordinated steps to enable the production of a new generation of clean vehicles with reduced GHG emissions and improved fuel efficiency from on-road vehicles and engines. These next steps include developing the first-ever GHG regulations for heavy-duty engines and vehicles, as well as additional light-duty vehicle GHG regulations. These steps were outlined by President Obama in a Presidential Memorandum on May 21, 2010.

The final combined U.S. EPA and NHTSA standards that make up the first phase of this national program apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. The standards require these vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile (the equivalent to 35.5 miles per gallon if the automobile industry were to meet this CO_2 level solely through fuel economy improvements). Together, these standards will cut GHG emissions by an estimated 960 MMT and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program (model years 2012-2016). On August 28, 2012, U.S. EPA and NHTSA issued their joint rule to extend this national program of coordinated GHG and fuel economy standards to model years 2017 through 2025 passenger vehicles.

State

Assembly Bill 1493

AB 1493 (Pavley) of 2002 (Health and Safety Code Sections 42823 and 43018.5) requires the ARB to develop and adopt the nation's first GHG emission standards for automobiles. These standards are also known as Pavley I. The California Legislature declared in AB 1493 that global warming is a matter of increasing concern for public health and the environment. It cites several risks that California faces from climate change, including a reduction in the state's water supply; an increase in air pollution caused by higher temperatures; harm to agriculture; an increase in wildfires; damage to the coastline; and economic losses caused by higher food, water, energy, and insurance prices. The bill also states that technological solutions to reduce GHG emissions would stimulate California's economy and provide jobs. In 2004, the State of California submitted a request for a waiver from federal clean air regulations, as the State is authorized to do under the FCAA, to allow the State to require reduced tailpipe emissions of CO_2. In late 2007, the U.S. EPA denied California's waiver request and declined to promulgate adequate federal regulations limiting GHG emissions. In early 2008, the State brought suit against the U.S. EPA related to this denial.

In January 2009, President Obama instructed the U.S. EPA to reconsider the Bush Administration's denial of California's and 13 other states' requests to implement global warming pollution standards for cars and trucks. In June 2009, the U.S. EPA granted California's waiver request, enabling the State to enforce its GHG emissions standards for new motor vehicles beginning with the current model year.

In 2009, President Obama announced a national policy aimed at both increasing fuel economy and reducing GHG pollution for all new cars and trucks sold in the US. The new standards would cover model years 2012 to 2016 and would raise passenger vehicle fuel economy to a fleet average of 35.5 miles per gallon by 2016. When the national program takes effect, California has committed to allowing automakers who show compliance with the national program to also be deemed in compliance with state requirements. California is committed to further strengthening these standards beginning in 2017 to obtain a 45 percent GHG reduction from the 2020 model year vehicles.

Executive Order No. S-3-05

Executive Order S-3-05 (State of California) proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, to the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

The Executive Order directed the secretary of the California Environmental Protection Agency (CalEPA) to coordinate a multi-agency effort to reduce GHG emissions to the target levels. The secretary will also submit biannual reports to the governor and state legislature describing (1) progress made toward reaching the emission targets, (2) impacts of global warming on California's resources, and (3) mitigation and adaptation plans to combat these impacts. To comply with the Executive Order, the secretary of CalEPA created a Climate Action Team made up of members from various state agencies and commissions. The Climate Action Team released its first report in March 2006 and continues to release periodic reports on progress. The report proposed to achieve the targets by building on voluntary actions of California businesses, local government and community actions, as well as through state incentive and regulatory programs.

Assembly Bill 32 - California Global Warming Solutions Act of 2006

AB 32 (Health and Safety Code Sections 38500, 38501, 28510, 38530, 38550, 38560, 38561–38565, 38570, 38571, 38574, 38580, 38590, 38592–38599) requires that statewide GHG emissions be reduced to 1990 levels by the year 2020. The gases that are regulated by AB 32 include CO_2, CH_4, N_2O, HFCs, PFCs, NF_3, and SF_6. The reduction to 1990 levels will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources. AB 32 specifies that regulations adopted in response to AB 1493 should be used to address GHG emissions from vehicles. However, AB 32 also includes language stating that if the AB 1493 regulations cannot be implemented, then ARB should develop new regulations to control vehicle GHG emissions under the authorization of AB 32.

AB 32 requires that ARB adopt a quantified cap on GHG emissions representing 1990 emissions levels and disclose how it arrives at the cap, institute a schedule to meet the emissions cap, and develop tracking, reporting, and enforcement mechanisms to ensure that the state achieves reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.

Climate Change Scoping Plan

In October 2008, ARB published its *Climate Change Proposed Scoping Plan*, which is the State's plan to achieve GHG reductions in California required by AB 32. This initial Scoping Plan contained the main strategies to be implemented in order to achieve the target emission levels identified in AB 32. The Scoping Plan included ARB-recommended GHG reductions for each emissions sector of the state's GHG inventory. The largest proposed GHG reduction recommendations were associated with improving emissions standards for light-duty vehicles, implementing the Low Carbon Fuel Standard program, implementation of energy efficiency measures in buildings and appliances, and the widespread development of combined heat and power systems, and developing a renewable portfolio standard for electricity production.

The Scoping Plan states that land use planning and urban growth decisions will play important roles in the state's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions. ARB further acknowledges that decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emissions sectors. With regard to land use planning, the Scoping Plan expects approximately 5.0 MMT CO_2e will be achieved associated with implementation of Senate Bill 375, which is discussed further below.

The initial Scoping Plan was first approved by ARB on December 11, 2008 and is updated every five years. The first update of the Scoping Plan was approved by the ARB on May 22, 2014, which looked past 2020 to set mid-term goals (2030-2035) on the road to reaching the 2050 goals., The most recent update released by ARB is the *2017 Climate Change Scoping Plan*, which was released In November 2017. The *2017 Climate Change Scoping Plan* incorporates strategies for achieving the 2030 GHG-reduction target established in SB 32 and EO B-30-15.

Senate Bill 1078 and Governor's Order S-14-08 (California Renewables Portfolio Standards)

Senate Bill 1078 (Public Utilities Code Sections 387, 390.1, 399.25 and Article 16) addresses electricity supply and requires that retail sellers of electricity, including investor-owned utilities and community choice aggregators, provide a minimum 20 percent of their supply from renewable sources by 2017. This Senate Bill will affect statewide GHG emissions associated with electricity generation. In 2008, Governor Schwarzenegger signed Executive Order S-14-08, which set the Renewables Portfolio Standard target to 33 percent by 2020. It directed state government agencies and retail sellers of electricity to take all appropriate actions to implement this target. Executive Order S-14-08 was later superseded by Executive Order S-21-09 on September 15, 2009. Executive Order S-21-09 directed the ARB to adopt regulations requiring 33 percent of electricity sold in the State come from renewable energy by 2020. Statute SB X1-2 superceded this Executive Order in 2011, which obligated all California electricity providers, including investor-owned utilities and publicly owned utilities, to obtain at least 33 percent of their energy from renewable electrical generation facilities by 2020.

ARB is required by current law, AB 32 of 2006, to regulate sources of GHGs to meet a state goal of reducing GHG emissions to 1990 levels by 2020 and an 80 percent reduction of 1990 levels by 2050. The California Energy Commissions and California Public Utilities Commission serve in advisory roles to help ARB develop the regulations to administer the 33 percent by 2020 requirement. ARB is also authorized to increase the target and accelerate and expand the time frame.

Mandatory Reporting of GHG Emissions

The California Global Warming Solutions Act (AB 32, 2006) requires the reporting of GHGs by major sources to the ARB. Major sources required to report GHG emissions include industrial facilities, suppliers of transportation fuels, natural gas, natural gas liquids, liquefied petroleum gas, and carbon dioxide, operators of petroleum and natural gas systems, and electricity retail providers and marketers.

Cap-and-Trade Regulation

The cap-and-trade regulation is a key element in California's climate plan. It sets a statewide limit on sources responsible for 85 percent of California's GHG emissions and establishes a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy. The cap-and-trade rules came into effect on January 1, 2013, and apply to large electric power plants and large industrial plants. In 2015, fuel distributors, including distributors of heating and transportation fuels, also became subject to the cap-and-trade rules. At that stage, the program will encompass around 360 businesses throughout California and nearly 85 percent of the state's total GHG emissions.

Under the cap-and-trade regulation, companies must hold enough emission allowances to cover their emissions and are free to buy and sell allowances on the open market. California held its first auction of GHG allowances on November 14, 2012. California's GHG cap-and-trade system is projected to reduce GHG emissions to 1990 levels by the year 2020 and would achieve an approximate 80 percent reduction from 1990 levels by 2050.

Senate Bill 32

SB 32 was signed by Governor Brown on September 8, 2016. SB 32 effectively extends California's GHG emission-reduction goals from year 2020 to year 2030. This new emission-reduction target of 40 percent below 1990 levels by 2030 is intended to promote further GHG-reductions in support of the State's ultimate goal of reducing GHG emissions by 80 percent below 1990 levels by 2050. SB 32 also directs the ARB to update the Climate Change Scoping Plan to address this interim 2030 emission-reduction target.

Senate Bill 375

SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a sustainable communities strategy (SCS) or alternative planning strategy (APS) that will address land use allocation in that MPOs regional transportation plan. ARB, in consultation with MPOs, establishes regional reduction targets for GHGs emitted by passenger cars and light trucks for the years 2020 and 2035. These reduction targets will be updated every eight years but can be updated every four years if advancements in emissions technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, funding for transportation projects may be withheld.

California Building Code

The California Building Code (CBC) contains standards that regulate the method of use, properties, performance, or types of materials used in the construction, alteration, improvement, repair, or rehabilitation of a building or other improvement to real property. The California Building Code is adopted every three years by the Building Standards Commission (BSC). In the interim, the BSC also adopts annual updates to make necessary mid-term corrections. The CBC standards apply statewide; however, a local jurisdiction may amend a CBC standard if it makes a finding that the amendment is reasonably necessary due to local climatic, geological, or topographical conditions.

Green Building Standards

In essence, green buildings standards are indistinguishable from any other building standards. Both standards are contained in the California Building Code and regulate the construction of new buildings and improvements. The only practical distinction between the two is that whereas the focus of traditional building standards has been protecting public health and safety, the focus of green building standards is to improve environmental performance.

AB 32, which mandates the reduction of GHG emissions in California to 1990 levels by 2020, increased the urgency around the adoption of green building standards. In its scoping plan for the implementation of AB 32, ARB identified energy use as the second largest contributor to California's GHG emissions, constituting roughly 25 percent of all such emissions. In recommending a green building strategy as one element of the scoping plan, ARB estimated that green building standards would reduce GHG emissions by approximately 26 MMT of CO_2e by 2020. The green buildings standards were most recently updated in 2016.

Senate Bill 97

Senate Bill 97 (SB 97) was enacted in 2007. SB 97 required OPR to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines addressing the analysis and mitigation of GHG emissions. Those CEQA Guidelines amendments clarified several points, including the following:

- Lead agencies must analyze the GHG emissions of proposed projects and must reach a conclusion regarding the significance of those emissions.
- When a project's GHG emissions may be significant, lead agencies must consider a range of potential mitigation measures to reduce those emissions.
- Lead agencies must analyze potentially significant impacts associated with placing projects in hazardous locations, including locations potentially affected by climate change.
- Lead agencies may significantly streamline the analysis of GHGs on a project level by using a programmatic GHG emissions reduction plan meeting certain criteria.
- CEQA mandates analysis of a proposed project's potential energy use (including transportation-related energy), sources of energy supply and ways to reduce energy demand, including through the use of efficient transportation alternatives.

Short-Lived Climate Pollutant Reduction Strategy

In March 2017, the ARB adopted the *Short-Lived Climate Pollutant Reduction Strategy* (*SLCP Strategy*) establishing a path to decrease GHG emissions and displace fossil-based natural gas use. Strategies include avoiding landfill methane emissions by reducing the disposal of organics through edible food recovery, composting, in-vessel digestion, and other processes; and recovering methane from wastewater treatment facilities, and manure methane at dairies, and using the methane as a renewable source of natural gas to fuel vehicles or generate electricity. The *SLCP Strategy* also identifies steps to reduce natural gas leaks from oil and gas wells, pipelines, valves, and pumps to improve safety, avoid energy losses, and reduce methane emissions associated with natural gas use. Lastly, the *SLCP Strategy* also identifies measures that can reduce hydrofluorocarbon (HFC) emissions at national and international levels, in addition to State-level action that includes an incentive program to encourage the use of low-Global Warming Potential (GWP) refrigerants, and limitations on the use of high-GWP refrigerants in new refrigeration and air-conditioning equipment (ARB 2017).

SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT

SJVAPCD Climate Change Action Plan

On August 21, 2008, the SJVAPCD Governing Board approved the SJVAPCD's *Climate Change Action Plan* with the following goals and actions:

Goals:

- Assist local land-use agencies with California Environmental Quality Act (CEQA) issues relative to projects with GHG emissions increases.
- Assist Valley businesses in complying with mandates of AB 32.
- Ensure that climate protection measures do not cause increase in toxic or criteria pollutants that adversely impact public health or environmental justice communities.

Actions:

- Authorize the Air Pollution Control Officer to develop GHG significance threshold(s) or other mechanisms to address CEQA projects with GHG emissions increases. Begin the requisite public process, including public workshops, and develop recommendations for Governing Board consideration in the spring of 2009.
- Authorize the Air Pollution Control Officer to develop necessary regulations and instruments for establishment and administration of the San Joaquin Valley Carbon Exchange Bank for voluntary GHG reductions created in the Valley. Begin the requisite public process, including public workshops, and develop recommendations for Governing Board consideration in spring 2009.
- Authorize the Air Pollution Control Officer to enhance the SJVAPCD's existing criteria pollutant emissions inventory reporting system to allow businesses subject to AB32 emission reporting requirements to submit simultaneous streamlined reports to the SJVAPCD and the state of California with minimal duplication.
- Authorize the Air Pollution Control Officer to develop and administer voluntary GHG emission reduction agreements to mitigate proposed GHG increases from new projects.
- Direct the Air Pollution Control Officer to support climate protection measures that reduce GHG emissions as well as toxic and criteria pollutants. Oppose measures that result in a significant increase in toxic or criteria pollutant emissions in already impacted area.

SJVAPCD CEQA Greenhouse Gas Guidance.

On December 17, 2009, the SJVAPCD Governing Board adopted "Guidance for Valley Land-use Agencies in Addressing GHG Emission Impacts for New Projects under CEQA" and the policy, "District Policy—Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency." The SJVAPCD concluded that the existing science is inadequate to support quantification of the impacts that project specific greenhouse gas emissions have on global climatic change. The SJVAPCD found the effects of project-specific emissions to be cumulative, and without mitigation, that their incremental contribution to global climatic change could be considered cumulatively considerable. The SJVAPCD found that this cumulative impact is best addressed by requiring all projects to reduce their greenhouse gas emissions, whether through project design elements or mitigation.

The SJVAPCD's approach is intended to streamline the process of determining if project-specific greenhouse gas emissions would have a significant effect. Projects exempt from the requirements of CEQA, and projects complying with an approved plan or mitigation program would be determined to have a less than significant cumulative impact. Such plans or programs must be specified in law or adopted by the public agency with jurisdiction over the affected resources and have a certified final CEQA document.

Best performance standards (BPS) would be established according to performance-based determinations. Projects complying with BPS would not require specific quantification of greenhouse gas emissions and would be determined to have a less than significant cumulative impact for greenhouse gas emissions. Projects not complying with BPS would require quantification of greenhouse gas emissions and demonstration that greenhouse gas emissions have been reduced or mitigated by 29 percent, as targeted by ARB's AB 32 Scoping Plan. Furthermore, quantification of greenhouse gas emissions would be required for all projects for which the lead agency has determined that an Environmental Impact Report is required, regardless of whether the project incorporates Best Performance Standards.

For stationary source permitting projects, best performance standards are "the most stringent of the identified alternatives for control of greenhouse gas emissions, including type of equipment, design of equipment and operational and maintenance practices, which are achieved-in-practice for the identified service, operation, or emissions unit class." For development projects, best performance standards are "any combination of identified greenhouse gas emission reduction measures, including project design elements and land use decisions that reduce project specific greenhouse gas emission reductions by at least 29 percent compared with business as usual." The SJVAPCD proposes to create a list of all approved Best Performance Standards to help in the determination as to whether a proposed project has reduced its GHG emissions by 29 percent.

IMPACTS & MITIGATION MEASURES

METHODOLOGY

Short-term Impacts

Short-term construction emissions associated with the proposed project were calculated using the CalEEMod computer program. Modeling includes emissions generated during site preparation/grading, asphalt paving, building construction, and application of architectural coatings. Detailed construction information, including construction schedules and equipment requirements, has not been identified for the proposed project. Default construction phases and equipment assumptions contained in the CalEEMod model were, therefore, relied upon for the calculation of construction-generated emissions. Modeling assumptions and output files are included in Appendix A of this report.

Long-term Impacts

Long-term operational GHG emissions associated with the proposed project were calculated using the CalEEMod computer program. Modeling was conducted based on traffic data derived, in part, from the traffic analysis prepared for the proposed project (JLB 2020). Mobile-source emissions were conservatively based on the default fleet distribution assumptions contained in the model. Energy use emissions were quantified assuming compliance with current building standards. According to the California Energy Commission, compliance with current building standards is estimated to result in a reduction of approximately 30 percent in electricity use for not residential land uses, in comparison to previous building standards. All other modeling assumptions were based on the default parameters contained in the CalEEMod computer model. Modeling assumptions and output files are included in Appendix A of this report.

THRESHOLDS OF SIGNIFICANCE

In accordance with Appendix G of the CEQA Guidelines Initial Study Checklist, a project would be considered to have a significant impact to climate change if it would:

a) Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or,

b) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.

San Joaquin Valley Air Pollution Control District

In accordance with the SJVAPCD's *Guidance for Valley Land-use Agencies in Addressing GHG Emission Impacts for New Projects Under CEQA* (SJVAPCD 2009), a project would be considered to have a less than significant impact on climate change if it would comply with at least one of the following criteria:

- Comply with an approved GHG emission reduction plan or GHG mitigation program which avoids or substantially reduces GHG emissions within the geographic area in which the project is located. Such plans or programs must be specified in law or approved by the lead agency with jurisdiction over the affected resource and supported by a CEQA compliant environmental review document adopted by the lead agency, or
- Implement approved best performance standards, or
- Quantify project GHG emissions and reduce those emissions by at least 29 percent compared to "business as usual" (BAU).

The SJVAPCD has not yet adopted best performance standards for development projects. The quantification of project-generated GHG emissions in comparison to BAU conditions to determine consistency with AB 32's reduction goals is considered appropriate in some instances. However, based on the California Supreme Court's decision in *Center for Biological Diversity v. California Department of Fish and Wildlife and Newhall Land and Farming (2015) 224 Cal.App.4th 1105 (CBD vs. CDFW;* also known as the *"Newhall Ranch case")*, substantial evidence would need to be provided to document that project-level reductions in comparison to a BAU approach would be consistent with achieving AB 32's overall statewide reduction goal. Given that AB 32's statewide goal includes reductions that are not necessarily related to an individual development project, the use of this approach may be difficult to support given the lack of substantial evidence to adequately demonstrate a link between the data contained in the AB 32 Scoping Plan and individual development projects. Alternatively, the Court identified potential options for evaluating GHG impacts for individual development projects, which included the use of GHG efficiency metrics. In general, GHG efficiency metrics can be used to assess the GHG efficiency of an individual project based on a per capita basis or on a service population basis.

A GHG efficiency threshold based on service population can be calculated by dividing the GHG emissions inventory goal (allowable emissions), by the estimated service population of the individual project. For most development projects, service population is traditionally defined as the sum of the number of jobs and the number of residents provided by a project. However, this traditional definition of service population may not be applicable to all projects, depending on the end use. For instance, with regard to schools, the student and employee population is the primary generator of GHG emissions with a majority of the school's emissions being associated with student vehicle trips. Therefore, the calculated GHG efficiency of the proposed project was expanded to include the proposed student and employee population. GHG efficiency for the proposed project was calculated for project opening year 2023, as well as, year 2030 to be consistent with the State's GHG-reduction target year. The methodology used for quantification of the target efficiency threshold applied to the proposed project is summarized in Table 9. Project-generated GHG emissions that would exceed the efficiency threshold of 4.2 $MTCO_2e$ per service population ($MTCO_2e$/SP/year) in year 2020 or 3.3 $MTCO_2e$/SP/year in 2030 would be considered to have a potentially significant impact on the environment that could conflict with GHG-reduction planning efforts. To be conservative, construction-generated GHG emissions were amortized based on an estimated 30-year project life and included in annual operational GHG emissions estimates.

Table 9. Project-Level GHG Efficiency Threshold Calculation

	2023	2030
Land Use Sectors GHG Emissions Target[1]	255,000,000	213,000,000
Population[2]	41,659,526	43,939,250
Employment[3]	19,442,770	20,795,940
Service Population	61,102,296	64,735,190
GHG Efficiency Threshold ($MTCO_2e$/SP/yr)	4.2	3.3

Based on AB 32 Scoping Plan's land use inventory sectors for years 2020 and 2030; Includes transportation sources.

1. *California Air Resources Board. California 1990 Greenhouse Gas Emissions Level and 2020 Limit — by Sector and Activity (Land Use-driven sectors only) MMT CO2e - (based upon IPCC Fourth Assessment Report Global Warming Potentials)*
2. *California Department of Finance Demographic Research Unit Report P-2 "State and County Population Projections by Race/Ethnicity and Age (5-year groups)" 2010 through 2060 (as of July 1). Published 12/15/2014*
3. *California Employment Development Department. 2019. Employment Projections Labor Market Information Resources and Data, "CA Long-Term. 2016-2026 Statewide Employment Projections". https://www.labormarketinfo.edd.ca.gov/data/employment-projections.html.*

PROJECT IMPACTS

Impact GHG-A. Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? And

Implementation of the proposed project would contribute to increases of GHG emissions that are associated with global climate change. Short-term and long-term GHG emissions associated with the development of the proposed project are discussed in greater detail, as follows:

Short-term Greenhouse Gas Emissions

Based on the modeling conducted, annual emissions of GHGs associated with construction of the proposed project would total approximately 361.3 $MTCO_2e$. There would also be a small amount of GHG emissions from waste generated during construction; however, this amount is speculative. Actual emissions would vary, depending on various factors including construction schedules, equipment required, and activities conducted. Assuming an average project life of 30 years, amortized construction-generated GHG emissions would total approximately 12.0 $MTCO_2e$/yr. Amortized construction-generated GHG emissions were included in the operational GHG emissions inventory for the evaluation of project-generated GHG emissions (refer to Table 10).

Long-term Greenhouse Gas Emissions

Estimated long-term increases in GHG emissions associated with the proposed project are summarized in Table 10. Based on the modeling conducted, operational GHG emissions would total approximately 1,374.7 $MTCO_2e$/year in 2023 and approximately 1,209.8 $MTCO_2e$/year in 2030. With the inclusion of amortized construction emissions, operational GHG emissions would total approximately 1,386.7 $MTCO_2e$/year in 2023 and approximately 1,209.8 $MTCO_2e$/year in 2030. Based on these estimates and assuming an on-site population of 600 students and 45 employees, the calculated GHG efficiency for the proposed project would be 2.1 $MTCO_2e$/SP/yr in 2023 and 1.9 $MTCO_2e$/SP/yr in 2030. The GHG efficiency for the proposed project would not exceed the thresholds of 4.2 $MTCO_2e$/SP/yr in 2023 or 3.3 $MTCO_2e$/SP/yr in 2030.

Based on the modeling conducted, the calculated GHG efficiency for the proposed project would be 2.1 $MTCO_2e$/SP/yr in 2023 and 1.9 $MTCO_2e$/SP/yr 2030. As depicted in Table 10, operational GHG emissions associated with the proposed project would be predominantly associated with mobile sources. It is important to note that mobile-source emissions were conservatively calculated, based on the default fleet-distribution assumptions contained in the model, which includes medium and heavy-duty vehicles. Mobile sources associated with schools typically consist largely to light-duty vehicles and buses. As a result, actual mobile-source emissions would be less. Because the GHG efficiency for the proposed project would not exceed the efficiency thresholds of 4.2 $MTCO_2e$/SP/yr in 2023 or 3.3 $MTCO_2e$/SP/yr in 2030, this impact would be considered ***less than significant***.

Table 10. Long-term Operational GHG Emissions

Emissions Source	GHG Emissions ($MTCO_2e$ per year) [1]	
	Year 2023	Year 2030
Energy Use	120.0	103.3
Mobile Sources[2]	1,221.9	1,062.9
Waste Generation[3]	27.5	27.5
Water Use[4]	5.3	4.1
Total Project Operational Emissions:	1,374.7	1,197.8
Amortized Construction Emissions:	12.0	12.0
Net Increase:	1386.7	1209.8
Project GHG Efficiency ($MTCO_2e$/SP/yr)[5]:	2.1	1.9
GHG Efficiency Threshold ($MTCO_2e$/SP/yr):	4.2	3.3
Exceeds Threshold/Significant Impact?	No	No

1. Project-generated emissions were quantified using the CalEEMod computer program.
2. Fleet distribution data for the project is not available. Mobile source emissions are conservatively based on default vehicle fleet distribution for Merced County, which includes all vehicle types/classificaations, including medium and heavy-duty vehicles. Actual emissions would likely be lower.
3. Based on state-wide waste diversion rate of 50 percent for 2020 and target diversion of 75% for 2030.
4. Includes installation of low-flow water fixtures and water-efficient irrigation systems, per California's 2015 water-efficiency standards. Includes compliance with current building energy-efficiency standards.
5. Based on a combined student and employee population of 645 individuals (OPR 2020).
Refer to Appendix A for modeling results and assumptions.

Impact GHG-B. Would the project conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?

As noted in Impact GHG-A, the proposed project would not result in increased GHG emissions that would conflict with AB 32 GHG-reduction targets. The proposed project would be designed to meet current building energy-efficiency standards, which includes measures to reduce overall energy use, water use, and waste generation. The project would also be designed to promote the use of alternative means of transportation, such as bicycle use, and to provide improved pedestrian access that would link the project site to nearby land uses. These improvements would help to further reduce the project's GHG emissions and would also help to reduce community-wide GHG emissions. For these reasons, the proposed project would not conflict with local or state GHG-reduction planning efforts. This impact would be considered ***less than significant***.

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APPENDIX A

EMISSIONS MODELING & DOCUMENTATION

AVERAGE-DAILY EMISSIONS

ANNUAL ON-SITE CONSTRUCTION EMISSIONS

	UNMITIGATED ANNUAL (TONS/YEAR)							UNMITIGATED AVG DAILY					
	ROG	NOX	CO	SO2	PM10	PM2.5	#DAYS	ROG	NOX	CO	SO2	PM10	PM2.5
SITE PREPARATION	0.00	0.02	0.02	0.00	0.00	0.00	3.00	1.33	13.33	13.33	0.00	2.00	0.67
GRADING	0.01	0.05	0.03	0.00	0.02	0.01	6.00	1.67	16.67	10.00	0.00	6.67	3.33
BUILDING	0.20	1.60	1.60	0.00	0.08	0.07	220.00	1.82	14.55	14.55	0.02	0.73	0.64
ARCH COATING	0.40	0.10	0.10	0.00	0.01	0.01	135.00	5.93	1.48	1.48	0.00	0.09	0.09
ASPHALT PAVING	0.01	0.05	0.06	0.00	0.00	0.00	10.00	1.40	10.00	12.00	0.02	0.40	0.40
TOTAL	0.61	1.82	1.81	0.00	0.11	0.09							
							AVG DAILY EMISSIONS (LBS/DAY):	5.93	16.67	14.55	0.02	6.67	3.33

ANNUAL ON-SITE OPERATIONAL EMISSIONS

	UNMITIGATED ANNUAL (TONS/YEAR)							UNMITIGATED ANNUAL (LBS/YEAR)					
	ROG	NOX	CO	SO2	PM10	PM2.5		ROG	NOX	CO	SO2	PM10	PM2.5
AREA	0.23	0.00	0.01	0.00	0.00	0.00		460.00	0.10	12.00	0.00	0.04	0.04
ENERGY	0.01	0.06	0.05	0.00	0.01	0.01		13.40	124.00	100.00	0.80	10.00	10.00
TOTAL						TOTAL		473.40	124.10	112.00	0.80	10.04	10.04
						OPERATIONAL PERIOD (DAYS):		260.00					
						AVG DAILY EMISSIONS (LBS/DAY):		1.82	0.48	0.43	0.00	0.04	0.04

OPERATIONAL ENERGY USE CALCULATION

REDUCTION PER CURRENT ENERGY CODE REQUIREMENTS: 30.0% (non-residential)

Source: CEC. 2018. *Energy Commission Adopts Standards Requiring Solar Systems for New Homes, First in Nation.*

Energy Use Emissions	Annual Emissions MTCO2e			
	Electricity without Adjustment	**Electricity with Adjustment**	**Nat Gas**	**Total**
Year 2023	74.8	52.36	67.6	119.96
Year 2030	51	35.7	67.6	103.3

GHG CALCULATION

STUDENTS:	600
STAFF:	45
TOTAL SERVICE POPULATION:	645

YEAR/SOURCE	EMISSIONS
YEAR 2023	
ENERGY	120.0
MOBILE	1221.9
WASTE	27.5
WATER	5.3
SUBTOTAL MTCO2e	1374.7
CONSTRUCTION	12.0
TOTAL MTCO2e	1386.7
MTCO2e/Yr/SP:	2.1
THRESHOLD:	4.2
YEAR 2030	
ENERGY	103.3
MOBILE	1062.9
WASTE	27.5
WATER	4.1
SUBTOTAL MTCO2e	1197.8
CONSTRUCTION	12.0
TOTAL MTCO2e	1209.8
MTCO2e/Yr/SP:	1.9
THRESHOLD:	3.3

Atwater Elementary School

Merced County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Elementary School	600.00	Student	8.15	50,162.02	0
Parking Lot	1.50	Acre	1.50	65,340.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	49
Climate Zone	3			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	438.13	**CH4 Intensity (lb/MWhr)**	0.02	**N2O Intensity (lb/MWhr)**	0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Includes RPS adjustment.

Land Use - Assumes 600-student ES. 1.5 acres asphalt surface.

Construction Phase - Demolition not required. Detailed contruction schedule is not available and based on model default of approx. 12 months. Architectural coating application assumed to begin 4 months after start of construction and distributed over the building construction period.

Off-road Equipment - Offroad equipment use based on model defaults.

Grading - No import/export of material anticipated. Construction trips based on model defaults.

Demolition - Demo not required

Vehicle Emission Factors - Vehicle fleet based on model defaults.

Vehicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Includes 50%CE for watering vehicle travel areas, 61%CE for watering graded surfaces, 15 mph onsite speed limit. T3 included for informational purposes.

Area Mitigation -

Energy Mitigation - Reductions for compliance with current building energy efficiency requirements calculated separately

Water Mitigation - Includes use of low-flow fixtures and water-efficient irrigation systems

Waste Mitigation - Assumes minimum waste diversion of 50%

Vehicle Trips - Assumes 1.89 trips/student per traffic analysis

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
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	10.00	135.00
tblConstructionPhase	PhaseEndDate	1/12/2023	11/17/2022
tblConstructionPhase	PhaseEndDate	12/15/2022	11/16/2022
tblConstructionPhase	PhaseEndDate	2/10/2022	1/12/2022
tblConstructionPhase	PhaseEndDate	12/29/2022	11/30/2022
tblConstructionPhase	PhaseEndDate	2/2/2022	1/5/2022
tblConstructionPhase	PhaseStartDate	12/30/2022	5/13/2022
tblConstructionPhase	PhaseStartDate	2/11/2022	1/13/2022
tblConstructionPhase	PhaseStartDate	2/3/2022	1/5/2022

tblConstructionPhase	PhaseStartDate	12/16/2022	11/17/2022
tblConstructionPhase	PhaseStartDate	1/29/2022	1/3/2022
tblProjectCharacteristics	CH4IntensityFactor	0.029	0.02
tblProjectCharacteristics	CO2IntensityFactor	641.35	438.13
tblProjectCharacteristics	N2OIntensityFactor	0.006	0.004
tblVehicleTrips	WD_TR	1.29	1.89

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					
2022	0.6243	2.0578	2.0170	4.1900e-003	0.0852	0.0893	0.1745	0.0275	0.0856	0.1131						361.3427
Maximum	**0.6243**	**2.0578**	**2.0170**	**4.1900e-003**	**0.0852**	**0.0893**	**0.1745**	**0.0275**	**0.0856**	**0.1131**						**361.3427**

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					
2022	0.4821	1.9179	2.1549	4.1900e-003	0.0717	0.1022	0.1739	0.0212	0.1022	0.1233						361.3424
Maximum	**0.4821**	**1.9179**	**2.1549**	**4.1900e-003**	**0.0717**	**0.1022**	**0.1739**	**0.0212**	**0.1022**	**0.1233**						**361.3424**

	ROG	**NOx**	**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	**22.79**	**6.80**	**-6.83**	**0.00**	**15.79**	**-14.45**	**0.31**	**23.01**	**-19.33**	**-9.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	1-1-2022	3-31-2022	0.5965	0.5102
2	4-1-2022	6-30-2022	0.7352	0.6627
3	7-1-2022	9-30-2022	0.8502	0.7740
		Highest	0.8502	0.7740

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	0.2369	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115
Energy	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						142.4285
Mobile	0.2518	2.8604	2.3813	0.0131	0.6839	7.3300e-003	0.6912	0.1842	6.8800e-003	0.1911						1,221.8639
Waste						0.0000	0.0000		0.0000	0.0000						55.0677
Water						0.0000	0.0000		0.0000	0.0000						6.1617
Total	**0.4954**	**2.9222**	**2.4387**	**0.0134**	**0.6839**	**0.0120**	**0.6959**	**0.1842**	**0.0116**	**0.1958**						**1,425.5333**

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	0.2369	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115
Energy	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						142.4285
Mobile	0.2518	2.8604	2.3813	0.0131	0.6839	7.3300e-003	0.6912	0.1842	6.8800e-003	0.1911						1,221.8639
Waste						0.0000	0.0000		0.0000	0.0000						27.5339
Water						0.0000	0.0000		0.0000	0.0000						5.2924
Total	**0.4954**	**2.9222**	**2.4387**	**0.0134**	**0.6839**	**0.0120**	**0.6959**	**0.1842**	**0.0116**	**0.1958**						**1,397.1301**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.99**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/3/2022	1/5/2022	5	3	
2	Grading	Grading	1/5/2022	1/12/2022	5	6	
3	Building Construction	Building Construction	1/13/2022	11/16/2022	5	220	
4	Architectural Coating	Architectural Coating	5/13/2022	11/17/2022	5	135	
5	Paving	Paving	11/17/2022	11/30/2022	5	10	

Acres of Grading (Site Preparation Phase): 4.5

Acres of Grading (Grading Phase): 3

Acres of Paving: 1.5

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 75,243; Non-Residential Outdoor: 25,081; Striped Parking Area: 3,920 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Cranes	1	8.00	231	0.29
Building Construction	Forklifts	2	7.00	89	0.20
Site Preparation	Graders	1	8.00	187	0.41
Paving	Pavers	1	8.00	130	0.42
Paving	Rollers	2	8.00	80	0.38
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Paving	Paving Equipment	1	8.00	132	0.36
Site Preparation	Scrapers	1	8.00	367	0.48
Building Construction	Welders	3	8.00	46	0.45

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
Site Preparation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	8	49.00	19.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	10.00	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

Use Soil Stabilizer

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2022

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					2.3900e-003	0.0000	2.3900e-003	2.6000e-004	0.0000	2.6000e-004						0.0000
Off-Road	2.0700e-003	0.0235	0.0151	4.0000e-005		8.9000e-004	8.9000e-004		8.2000e-004	8.2000e-004						3.2582
Total	**2.0700e-003**	**0.0235**	**0.0151**	**4.0000e-005**	**2.3900e-003**	**8.9000e-004**	**3.2800e-003**	**2.6000e-004**	**8.2000e-004**	**1.0800e-003**						**3.2582**

3.2 Site Preparation - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	5.0000e-005	3.0000e-005	3.3000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005						0.0816
Total	**5.0000e-005**	**3.0000e-005**	**3.3000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**						**0.0816**

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					9.3000e-004	0.0000	9.3000e-004	1.0000e-004	0.0000	1.0000e-004						0.0000
Off-Road	9.0000e-004	0.0178	0.0205	4.0000e-005		7.5000e-004	7.5000e-004		7.5000e-004	7.5000e-004						3.2582
Total	**9.0000e-004**	**0.0178**	**0.0205**	**4.0000e-005**	**9.3000e-004**	**7.5000e-004**	**1.6800e-003**	**1.0000e-004**	**7.5000e-004**	**8.5000e-004**						**3.2582**

3.2 Site Preparation - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	5.0000e-005	3.0000e-005	3.3000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005						0.0816
Total	**5.0000e-005**	**3.0000e-005**	**3.3000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**						**0.0816**

3.3 Grading - 2022

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					0.0197	0.0000	0.0197	0.0101	0.0000	0.0101						0.0000
Off-Road	4.6200e-003	0.0510	0.0277	6.0000e-005		2.2300e-003	2.2300e-003		2.0500e-003	2.0500e-003						5.4747
Total	**4.6200e-003**	**0.0510**	**0.0277**	**6.0000e-005**	**0.0197**	**2.2300e-003**	**0.0219**	**0.0101**	**2.0500e-003**	**0.0122**						**5.4747**

3.3 Grading - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	1.2000e-004	8.0000e-005	8.3000e-004	0.0000	2.4000e-004	0.0000	2.4000e-004	6.0000e-005	0.0000	7.0000e-005						0.2039
Total	**1.2000e-004**	**8.0000e-005**	**8.3000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**2.4000e-004**	**6.0000e-005**	**0.0000**	**7.0000e-005**						**0.2039**

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					7.6700e-003	0.0000	7.6700e-003	3.9400e-003	0.0000	3.9400e-003						0.0000
Off-Road	1.5100e-003	0.0307	0.0364	6.0000e-005		1.4600e-003	1.4600e-003		1.4600e-003	1.4600e-003						5.4747
Total	**1.5100e-003**	**0.0307**	**0.0364**	**6.0000e-005**	**7.6700e-003**	**1.4600e-003**	**9.1300e-003**	**3.9400e-003**	**1.4600e-003**	**5.4000e-003**						**5.4747**

3.3 Grading - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	1.2000e-004	8.0000e-005	8.3000e-004	0.0000	2.4000e-004	0.0000	2.4000e-004	6.0000e-005	0.0000	7.0000e-005						0.2039
Total	**1.2000e-004**	**8.0000e-005**	**8.3000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**2.4000e-004**	**6.0000e-005**	**0.0000**	**7.0000e-005**						**0.2039**

3.4 Building Construction - 2022

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	0.2041	1.6064	1.5789	2.7500e-003		0.0772	0.0772		0.0740	0.0740						229.5500
Total	**0.2041**	**1.6064**	**1.5789**	**2.7500e-003**		**0.0772**	**0.0772**		**0.0740**	**0.0740**						**229.5500**

3.4 Building Construction - 2022

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
Vendor	6.7600e-003	0.2193	0.0437	5.9000e-004	0.0138	6.2000e-004	0.0145	4.0000e-003	5.9000e-004	4.5900e-003						55.9590
Worker	0.0208	0.0138	0.1490	4.1000e-004	0.0430	3.2000e-004	0.0433	0.0114	2.9000e-004	0.0117						36.6382
Total	**0.0276**	**0.2331**	**0.1927**	**1.0000e-003**	**0.0568**	**9.4000e-004**	**0.0578**	**0.0154**	**8.8000e-004**	**0.0163**						**92.5973**

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	0.0785	1.4984	1.6949	2.7500e-003		0.0900	0.0900		0.0900	0.0900						229.5497
Total	**0.0785**	**1.4984**	**1.6949**	**2.7500e-003**		**0.0900**	**0.0900**		**0.0900**	**0.0900**						**229.5497**

3.4 Building Construction - 2022

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
Vendor	6.7600e-003	0.2193	0.0437	5.9000e-004	0.0138	6.2000e-004	0.0145	4.0000e-003	5.9000e-004	4.5900e-003						55.9590
Worker	0.0208	0.0138	0.1490	4.1000e-004	0.0430	3.2000e-004	0.0433	0.0114	2.9000e-004	0.0117						36.6382
Total	**0.0276**	**0.2331**	**0.1927**	**1.0000e-003**	**0.0568**	**9.4000e-004**	**0.0578**	**0.0154**	**8.8000e-004**	**0.0163**						**92.5973**

3.5 Architectural Coating - 2022

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	0.3624					0.0000	0.0000		0.0000	0.0000						0.0000
Off-Road	0.0138	0.0951	0.1224	2.0000e-004		5.5200e-003	5.5200e-003		5.5200e-003	5.5200e-003						17.2625
Total	**0.3762**	**0.0951**	**0.1224**	**2.0000e-004**		**5.5200e-003**	**5.5200e-003**		**5.5200e-003**	**5.5200e-003**						**17.2625**

3.5 Architectural Coating - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.6100e-003	1.7300e-003	0.0187	5.0000e-005	5.3800e-003	4.0000e-005	5.4200e-003	1.4300e-003	4.0000e-005	1.4700e-003						4.5883
Total	**2.6100e-003**	**1.7300e-003**	**0.0187**	**5.0000e-005**	**5.3800e-003**	**4.0000e-005**	**5.4200e-003**	**1.4300e-003**	**4.0000e-005**	**1.4700e-003**						**4.5883**

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	0.3624					0.0000	0.0000		0.0000	0.0000						0.0000
Off-Road	4.0100e-003	0.0916	0.1237	2.0000e-004		6.4200e-003	6.4200e-003		6.4200e-003	6.4200e-003						17.2625
Total	**0.3664**	**0.0916**	**0.1237**	**2.0000e-004**		**6.4200e-003**	**6.4200e-003**		**6.4200e-003**	**6.4200e-003**						**17.2625**

3.5 Architectural Coating - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.6100e-003	1.7300e-003	0.0187	5.0000e-005	5.3800e-003	4.0000e-005	5.4200e-003	1.4300e-003	4.0000e-005	1.4700e-003						4.5883
Total	**2.6100e-003**	**1.7300e-003**	**0.0187**	**5.0000e-005**	**5.3800e-003**	**4.0000e-005**	**5.4200e-003**	**1.4300e-003**	**4.0000e-005**	**1.4700e-003**						**4.5883**

3.6 Paving - 2022

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	4.7100e-003	0.0467	0.0585	9.0000e-005		2.4400e-003	2.4400e-003		2.2500e-003	2.2500e-003						7.8165
Paving	1.9700e-003					0.0000	0.0000		0.0000	0.0000						0.0000
Total	**6.6800e-003**	**0.0467**	**0.0585**	**9.0000e-005**		**2.4400e-003**	**2.4400e-003**		**2.2500e-003**	**2.2500e-003**						**7.8165**

3.6 Paving - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.9000e-004	1.9000e-004	2.0700e-003	1.0000e-005	6.0000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004						0.5098
Total	**2.9000e-004**	**1.9000e-004**	**2.0700e-003**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**6.0000e-004**	**1.6000e-004**	**0.0000**	**1.6000e-004**						**0.5098**

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	2.1000e-003	0.0443	0.0649	9.0000e-005		2.6500e-003	2.6500e-003		2.6500e-003	2.6500e-003						7.8165
Paving	1.9700e-003					0.0000	0.0000		0.0000	0.0000						0.0000
Total	**4.0700e-003**	**0.0443**	**0.0649**	**9.0000e-005**		**2.6500e-003**	**2.6500e-003**		**2.6500e-003**	**2.6500e-003**						**7.8165**

3.6 Paving - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.9000e-004	1.9000e-004	2.0700e-003	1.0000e-005	6.0000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004						0.5098
Total	**2.9000e-004**	**1.9000e-004**	**2.0700e-003**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**6.0000e-004**	**1.6000e-004**	**0.0000**	**1.6000e-004**						**0.5098**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.2518	2.8604	2.3813	0.0131	0.6839	7.3300e-003	0.6912	0.1842	6.8800e-003	0.1911						1,221.8639
Unmitigated	0.2518	2.8604	2.3813	0.0131	0.6839	7.3300e-003	0.6912	0.1842	6.8800e-003	0.1911						1,221.8639

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Elementary School	1,134.00	0.00	0.00	1,786,001	1,786,001
Parking Lot	0.00	0.00	0.00		
Total	1,134.00	0.00	0.00	1,786,001	1,786,001

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
Elementary School	9.50	7.30	7.30	65.00	30.00	5.00	63	25	12
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Elementary School	0.504505	0.029429	0.155974	0.104791	0.016717	0.004370	0.015463	0.156066	0.002403	0.002061	0.006105	0.001524	0.000591
Parking Lot	0.504505	0.029429	0.155974	0.104791	0.016717	0.004370	0.015463	0.156066	0.002403	0.002061	0.006105	0.001524	0.000591

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000						74.8137
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000						74.8137
NaturalGas Mitigated	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
NaturalGas Unmitigated	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148

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					
Elementary School	1.25957e+006	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000						0.0000
Total		**6.7900e-003**	**0.0617**	**0.0519**	**3.7000e-004**		**4.6900e-003**	**4.6900e-003**		**4.6900e-003**	**4.6900e-003**						**67.6148**

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					
Elementary School	1.25957e+006	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000						0.0000
Total		**6.7900e-003**	**0.0617**	**0.0519**	**3.7000e-004**		**4.6900e-003**	**4.6900e-003**		**4.6900e-003**	**4.6900e-003**						**67.6148**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Elementary School	352137				70.2514
Parking Lot	22869				4.5624
Total					**74.8137**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Elementary School	352137				70.2514
Parking Lot	22869				4.5624
Total					**74.8137**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.2369	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115
Unmitigated	0.2369	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115

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	0.0362					0.0000	0.0000		0.0000	0.0000						0.0000
Consumer Products	0.2001					0.0000	0.0000		0.0000	0.0000						0.0000
Landscaping	5.1000e-004	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115
Total	**0.2369**	**5.0000e-005**	**5.5300e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**						**0.0115**

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	0.0362					0.0000	0.0000		0.0000	0.0000						0.0000
Consumer Products	0.2001					0.0000	0.0000		0.0000	0.0000						0.0000
Landscaping	5.1000e-004	5.0000e-005	5.5300e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0115
Total	**0.2369**	**5.0000e-005**	**5.5300e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**						**0.0115**

7.0 Water Detail

7.1 Mitigation Measures Water

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Use Water Efficient Irrigation System

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated				5.2924
Unmitigated				6.1617

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Elementary School	1.45454 / 3.74026				6.1617
Parking Lot	0 / 0				0.0000
Total					**6.1617**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Elementary School	1.16364 / 3.5121				5.2924
Parking Lot	0 / 0				0.0000
Total					**5.2924**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated				27.5339
Unmitigated				55.0677

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Elementary School	109.5				55.0677
Parking Lot	0				0.0000
Total					**55.0677**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Elementary School	54.75				27.5339
Parking Lot	0				0.0000
Total					**27.5339**

9.0 Operational Offroad

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

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

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

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Atwater Elementary School

Merced County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Elementary School	600.00	Student	8.15	50,162.02	0
Parking Lot	1.50	Acre	1.50	65,340.00	0

1.2 Other Project Characteristics

Urbanization Urban

Wind Speed (m/s) 2.2

Precipitation Freq (Days) 49

Climate Zone 3

Operational Year 2030

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 298.3

CH4 Intensity (lb/MWhr) 0.013

N2O Intensity (lb/MWhr) 0.003

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Includes RPS adjustment.

Land Use - Assumes 600-student ES. 1.5 acres asphalt surface.

Construction Phase - Demolition not required. Detailed contruction schedule is not available and based on model default of approx. 12 months. Architectural coating application assumed to begin 4 months after start of construction and distributed over the building construction period.

Off-road Equipment - Offroad equipment use based on model defaults.

Grading - No import/export of material anticipated. Construction trips based on model defaults.

Demolition - Demo not required

Vehicle Emission Factors - Vehicle fleet based on model defaults.

Vehicle Emission Factors -

Energy Use -

Construction Off-road Equipment Mitigation - Includes 50%CE for watering vehicle travel areas, 61%CE for watering graded surfaces, 15 mph onsite speed limit. T3 included for informational purposes.

Area Mitigation -

Energy Mitigation - Reductions for compliance with current building energy efficiency requirements calculated separately

Water Mitigation - Includes use of low-flow fixtures and water-efficient irrigation systems

Waste Mitigation - Assumes minimum waste diversion of 50%

Vehicle Trips - Assumes 1.89 trips/student per traffic analysis

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
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	10.00	135.00
tblConstructionPhase	PhaseEndDate	1/12/2023	11/17/2022
tblConstructionPhase	PhaseEndDate	12/15/2022	11/16/2022
tblConstructionPhase	PhaseEndDate	2/10/2022	1/12/2022
tblConstructionPhase	PhaseEndDate	12/29/2022	11/30/2022
tblConstructionPhase	PhaseEndDate	2/2/2022	1/5/2022
tblConstructionPhase	PhaseStartDate	12/30/2022	5/13/2022
tblConstructionPhase	PhaseStartDate	2/11/2022	1/13/2022
tblConstructionPhase	PhaseStartDate	2/3/2022	1/5/2022

tblConstructionPhase	PhaseStartDate	12/16/2022	11/17/2022
tblConstructionPhase	PhaseStartDate	1/29/2022	1/3/2022
tblProjectCharacteristics	CH4IntensityFactor	0.029	0.013
tblProjectCharacteristics	CO2IntensityFactor	641.35	298.3
tblProjectCharacteristics	N2OIntensityFactor	0.006	0.003
tblVehicleTrips	WD_TR	1.29	1.89

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					
2022	0.6243	2.0578	2.0170	4.1900e-003	0.0852	0.0893	0.1745	0.0275	0.0856	0.1131						361.3427
Maximum	**0.6243**	**2.0578**	**2.0170**	**4.1900e-003**	**0.0852**	**0.0893**	**0.1745**	**0.0275**	**0.0856**	**0.1131**						**361.3427**

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					
2022	0.4821	1.9179	2.1549	4.1900e-003	0.0717	0.1022	0.1739	0.0212	0.1022	0.1233						361.3424
Maximum	**0.4821**	**1.9179**	**2.1549**	**4.1900e-003**	**0.0717**	**0.1022**	**0.1739**	**0.0212**	**0.1022**	**0.1233**						**361.3424**

	ROG	**NOx**	**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	**22.79**	**6.80**	**-6.83**	**0.00**	**15.79**	**-14.45**	**0.31**	**23.01**	**-19.33**	**-9.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**1-1-2022**	**3-31-2022**	0.5965	0.5102
2	**4-1-2022**	**6-30-2022**	0.7352	0.6627
3	**7-1-2022**	**9-30-2022**	0.8502	0.7740
		Highest	0.8502	0.7740

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	0.2369	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114
Energy	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						118.5630
Mobile	0.1763	2.4881	1.5741	0.0113	0.6820	5.3800e-003	0.6874	0.1835	5.0400e-003	0.1885						1,062.9078
Waste						0.0000	0.0000		0.0000	0.0000						55.0677
Water						0.0000	0.0000		0.0000	0.0000						4.8277
Total	**0.4200**	**2.5498**	**1.6314**	**0.0117**	**0.6820**	**0.0101**	**0.6921**	**0.1835**	**9.7500e-003**	**0.1932**						**1,241.3776**

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	0.2369	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114
Energy	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						118.5630
Mobile	0.1763	2.4881	1.5741	0.0113	0.6820	5.3800e-003	0.6874	0.1835	5.0400e-003	0.1885						1,062.9078
Waste						0.0000	0.0000		0.0000	0.0000						27.5339
Water						0.0000	0.0000		0.0000	0.0000						4.1094
Total	**0.4200**	**2.5498**	**1.6314**	**0.0117**	**0.6820**	**0.0101**	**0.6921**	**0.1835**	**9.7500e-003**	**0.1932**						**1,213.1255**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.28**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/3/2022	1/5/2022	5	3	
2	Grading	Grading	1/5/2022	1/12/2022	5	6	
3	Building Construction	Building Construction	1/13/2022	11/16/2022	5	220	
4	Architectural Coating	Architectural Coating	5/13/2022	11/17/2022	5	135	
5	Paving	Paving	11/17/2022	11/30/2022	5	10	

Acres of Grading (Site Preparation Phase): 4.5

Acres of Grading (Grading Phase): 3

Acres of Paving: 1.5

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 75,243; Non-Residential Outdoor: 25,081; Striped Parking Area: 3,920 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Cranes	1	8.00	231	0.29
Building Construction	Forklifts	2	7.00	89	0.20
Site Preparation	Graders	1	8.00	187	0.41
Paving	Pavers	1	8.00	130	0.42
Paving	Rollers	2	8.00	80	0.38
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Grading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Paving	Paving Equipment	1	8.00	132	0.36
Site Preparation	Scrapers	1	8.00	367	0.48
Building Construction	Welders	3	8.00	46	0.45

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
Site Preparation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	4	10.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	8	49.00	19.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	10.00	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

Use Soil Stabilizer

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Site Preparation - 2022

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					2.3900e-003	0.0000	2.3900e-003	2.6000e-004	0.0000	2.6000e-004						0.0000
Off-Road	2.0700e-003	0.0235	0.0151	4.0000e-005		8.9000e-004	8.9000e-004		8.2000e-004	8.2000e-004						3.2582
Total	**2.0700e-003**	**0.0235**	**0.0151**	**4.0000e-005**	**2.3900e-003**	**8.9000e-004**	**3.2800e-003**	**2.6000e-004**	**8.2000e-004**	**1.0800e-003**						**3.2582**

3.2 Site Preparation - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	5.0000e-005	3.0000e-005	3.3000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005						0.0816
Total	**5.0000e-005**	**3.0000e-005**	**3.3000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**						**0.0816**

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					9.3000e-004	0.0000	9.3000e-004	1.0000e-004	0.0000	1.0000e-004						0.0000
Off-Road	9.0000e-004	0.0178	0.0205	4.0000e-005		7.5000e-004	7.5000e-004		7.5000e-004	7.5000e-004						3.2582
Total	**9.0000e-004**	**0.0178**	**0.0205**	**4.0000e-005**	**9.3000e-004**	**7.5000e-004**	**1.6800e-003**	**1.0000e-004**	**7.5000e-004**	**8.5000e-004**						**3.2582**

3.2 Site Preparation - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	5.0000e-005	3.0000e-005	3.3000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005						0.0816
Total	**5.0000e-005**	**3.0000e-005**	**3.3000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**						**0.0816**

3.3 Grading - 2022

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					0.0197	0.0000	0.0197	0.0101	0.0000	0.0101						0.0000
Off-Road	4.6200e-003	0.0510	0.0277	6.0000e-005		2.2300e-003	2.2300e-003		2.0500e-003	2.0500e-003						5.4747
Total	**4.6200e-003**	**0.0510**	**0.0277**	**6.0000e-005**	**0.0197**	**2.2300e-003**	**0.0219**	**0.0101**	**2.0500e-003**	**0.0122**						**5.4747**

3.3 Grading - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	1.2000e-004	8.0000e-005	8.3000e-004	0.0000	2.4000e-004	0.0000	2.4000e-004	6.0000e-005	0.0000	7.0000e-005						0.2039
Total	**1.2000e-004**	**8.0000e-005**	**8.3000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**2.4000e-004**	**6.0000e-005**	**0.0000**	**7.0000e-005**						**0.2039**

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					7.6700e-003	0.0000	7.6700e-003	3.9400e-003	0.0000	3.9400e-003						0.0000
Off-Road	1.5100e-003	0.0307	0.0364	6.0000e-005		1.4600e-003	1.4600e-003		1.4600e-003	1.4600e-003						5.4747
Total	**1.5100e-003**	**0.0307**	**0.0364**	**6.0000e-005**	**7.6700e-003**	**1.4600e-003**	**9.1300e-003**	**3.9400e-003**	**1.4600e-003**	**5.4000e-003**						**5.4747**

3.3 Grading - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	1.2000e-004	8.0000e-005	8.3000e-004	0.0000	2.4000e-004	0.0000	2.4000e-004	6.0000e-005	0.0000	7.0000e-005						0.2039
Total	**1.2000e-004**	**8.0000e-005**	**8.3000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**2.4000e-004**	**6.0000e-005**	**0.0000**	**7.0000e-005**						**0.2039**

3.4 Building Construction - 2022

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	0.2041	1.6064	1.5789	2.7500e-003		0.0772	0.0772		0.0740	0.0740						229.5500
Total	**0.2041**	**1.6064**	**1.5789**	**2.7500e-003**		**0.0772**	**0.0772**		**0.0740**	**0.0740**						**229.5500**

3.4 Building Construction - 2022

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
Vendor	6.7600e-003	0.2193	0.0437	5.9000e-004	0.0138	6.2000e-004	0.0145	4.0000e-003	5.9000e-004	4.5900e-003						55.9590
Worker	0.0208	0.0138	0.1490	4.1000e-004	0.0430	3.2000e-004	0.0433	0.0114	2.9000e-004	0.0117						36.6382
Total	**0.0276**	**0.2331**	**0.1927**	**1.0000e-003**	**0.0568**	**9.4000e-004**	**0.0578**	**0.0154**	**8.8000e-004**	**0.0163**						**92.5973**

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	0.0785	1.4984	1.6949	2.7500e-003		0.0900	0.0900		0.0900	0.0900						229.5497
Total	**0.0785**	**1.4984**	**1.6949**	**2.7500e-003**		**0.0900**	**0.0900**		**0.0900**	**0.0900**						**229.5497**

3.4 Building Construction - 2022

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
Vendor	6.7600e-003	0.2193	0.0437	5.9000e-004	0.0138	6.2000e-004	0.0145	4.0000e-003	5.9000e-004	4.5900e-003						55.9590
Worker	0.0208	0.0138	0.1490	4.1000e-004	0.0430	3.2000e-004	0.0433	0.0114	2.9000e-004	0.0117						36.6382
Total	**0.0276**	**0.2331**	**0.1927**	**1.0000e-003**	**0.0568**	**9.4000e-004**	**0.0578**	**0.0154**	**8.8000e-004**	**0.0163**						**92.5973**

3.5 Architectural Coating - 2022

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	0.3624					0.0000	0.0000		0.0000	0.0000						0.0000
Off-Road	0.0138	0.0951	0.1224	2.0000e-004		5.5200e-003	5.5200e-003		5.5200e-003	5.5200e-003						17.2625
Total	**0.3762**	**0.0951**	**0.1224**	**2.0000e-004**		**5.5200e-003**	**5.5200e-003**		**5.5200e-003**	**5.5200e-003**						**17.2625**

3.5 Architectural Coating - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.6100e-003	1.7300e-003	0.0187	5.0000e-005	5.3800e-003	4.0000e-005	5.4200e-003	1.4300e-003	4.0000e-005	1.4700e-003						4.5883
Total	**2.6100e-003**	**1.7300e-003**	**0.0187**	**5.0000e-005**	**5.3800e-003**	**4.0000e-005**	**5.4200e-003**	**1.4300e-003**	**4.0000e-005**	**1.4700e-003**						**4.5883**

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	0.3624					0.0000	0.0000		0.0000	0.0000						0.0000
Off-Road	4.0100e-003	0.0916	0.1237	2.0000e-004		6.4200e-003	6.4200e-003		6.4200e-003	6.4200e-003						17.2625
Total	**0.3664**	**0.0916**	**0.1237**	**2.0000e-004**		**6.4200e-003**	**6.4200e-003**		**6.4200e-003**	**6.4200e-003**						**17.2625**

3.5 Architectural Coating - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.6100e-003	1.7300e-003	0.0187	5.0000e-005	5.3800e-003	4.0000e-005	5.4200e-003	1.4300e-003	4.0000e-005	1.4700e-003						4.5883
Total	**2.6100e-003**	**1.7300e-003**	**0.0187**	**5.0000e-005**	**5.3800e-003**	**4.0000e-005**	**5.4200e-003**	**1.4300e-003**	**4.0000e-005**	**1.4700e-003**						**4.5883**

3.6 Paving - 2022

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	4.7100e-003	0.0467	0.0585	9.0000e-005		2.4400e-003	2.4400e-003		2.2500e-003	2.2500e-003						7.8165
Paving	1.9700e-003					0.0000	0.0000		0.0000	0.0000						0.0000
Total	**6.6800e-003**	**0.0467**	**0.0585**	**9.0000e-005**		**2.4400e-003**	**2.4400e-003**		**2.2500e-003**	**2.2500e-003**						**7.8165**

3.6 Paving - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.9000e-004	1.9000e-004	2.0700e-003	1.0000e-005	6.0000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004						0.5098
Total	**2.9000e-004**	**1.9000e-004**	**2.0700e-003**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**6.0000e-004**	**1.6000e-004**	**0.0000**	**1.6000e-004**						**0.5098**

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	2.1000e-003	0.0443	0.0649	9.0000e-005		2.6500e-003	2.6500e-003		2.6500e-003	2.6500e-003						7.8165
Paving	1.9700e-003					0.0000	0.0000		0.0000	0.0000						0.0000
Total	**4.0700e-003**	**0.0443**	**0.0649**	**9.0000e-005**		**2.6500e-003**	**2.6500e-003**		**2.6500e-003**	**2.6500e-003**						**7.8165**

3.6 Paving - 2022

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
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000						0.0000
Worker	2.9000e-004	1.9000e-004	2.0700e-003	1.0000e-005	6.0000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004						0.5098
Total	**2.9000e-004**	**1.9000e-004**	**2.0700e-003**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**6.0000e-004**	**1.6000e-004**	**0.0000**	**1.6000e-004**						**0.5098**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.1763	2.4881	1.5741	0.0113	0.6820	5.3800e-003	0.6874	0.1835	5.0400e-003	0.1885						1,062.907 8
Unmitigated	0.1763	2.4881	1.5741	0.0113	0.6820	5.3800e-003	0.6874	0.1835	5.0400e-003	0.1885						1,062.907 8

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Elementary School	1,134.00	0.00	0.00	1,786,001	1,786,001
Parking Lot	0.00	0.00	0.00		
Total	1,134.00	0.00	0.00	1,786,001	1,786,001

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
Elementary School	9.50	7.30	7.30	65.00	30.00	5.00	63	25	12
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Elementary School	0.534827	0.027180	0.159779	0.085696	0.010184	0.003355	0.014433	0.153313	0.002347	0.001594	0.005527	0.001331	0.000436
Parking Lot	0.534827	0.027180	0.159779	0.085696	0.010184	0.003355	0.014433	0.153313	0.002347	0.001594	0.005527	0.001331	0.000436

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000						50.9482
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000						50.9482
NaturalGas Mitigated	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
NaturalGas Unmitigated	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148

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					
Elementary School	1.25957e+006	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000						0.0000
Total		**6.7900e-003**	**0.0617**	**0.0519**	**3.7000e-004**		**4.6900e-003**	**4.6900e-003**		**4.6900e-003**	**4.6900e-003**						**67.6148**

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					
Elementary School	1.25957e+006	6.7900e-003	0.0617	0.0519	3.7000e-004		4.6900e-003	4.6900e-003		4.6900e-003	4.6900e-003						67.6148
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000						0.0000
Total		**6.7900e-003**	**0.0617**	**0.0519**	**3.7000e-004**		**4.6900e-003**	**4.6900e-003**		**4.6900e-003**	**4.6900e-003**						**67.6148**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Elementary School	352137				47.8412
Parking Lot	22869				3.1070
Total					**50.9482**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Elementary School	352137				47.8412
Parking Lot	22869				3.1070
Total					**50.9482**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.2369	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114
Unmitigated	0.2369	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114

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	0.0362					0.0000	0.0000		0.0000	0.0000						0.0000
Consumer Products	0.2001					0.0000	0.0000		0.0000	0.0000						0.0000
Landscaping	5.0000e-004	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114
Total	**0.2369**	**5.0000e-005**	**5.5000e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**						**0.0114**

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	0.0362					0.0000	0.0000		0.0000	0.0000						0.0000
Consumer Products	0.2001					0.0000	0.0000		0.0000	0.0000						0.0000
Landscaping	5.0000e-004	5.0000e-005	5.5000e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005						0.0114
Total	**0.2369**	**5.0000e-005**	**5.5000e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**						**0.0114**

7.0 Water Detail

7.1 Mitigation Measures Water

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Use Water Efficient Irrigation System

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated				4.1094
Unmitigated				4.8277

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Elementary School	1.45454 / 3.74026				4.8277
Parking Lot	0 / 0				0.0000
Total					**4.8277**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Elementary School	1.16364 / 3.5121				4.1094
Parking Lot	0 / 0				0.0000
Total					**4.1094**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated				27.5339
Unmitigated				55.0677

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Elementary School	109.5				55.0677
Parking Lot	0				0.0000
Total					**55.0677**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Elementary School	54.75				27.5339
Parking Lot	0				0.0000
Total					**27.5339**

9.0 Operational Offroad

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

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

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

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Appendix B

Biological Resources Reports:

CNDDB Occurrence Report

IPaC Trust Resources Report

Element_Type	Scientific_Name	Common_Name	Element_Code	Federal_Status	State_Status	CDFW_Status	CA_Rare_Plant_Rank	Quad_Code	Quad_Name	Data_Status	Taxonomic_Sort
Animals - Birds	Buteo regalis	ferruginous hawk	ABNKC19120	None	None	WL	-	3712035	ATWATER	Mapped	Animals - Birds - Accipitridae - Buteo regalis
Animals - Birds	Buteo swainsoni	Swainson's hawk	ABNKC19070	None	Threatened	-	-	3712035	ATWATER	Mapped and Unprocessed	Animals - Birds - Accipitridae - Buteo swainsoni
Animals - Birds	Agelaius tricolor	tricolored blackbird	ABPBXB0020	None	Threatened	SSC	-	3712035	ATWATER	Mapped	Animals - Birds - Icteridae - Agelaius tricolor
Animals - Birds	Chlidonias niger	black tern	ABNNM10020	None	None	SSC	-	3712035	ATWATER	Unprocessed	Animals - Birds - Laridae - Chlidonias niger
Animals - Birds	Athene cunicularia	burrowing owl	ABNSB10010	None	None	SSC	-	3712035	ATWATER	Mapped	Animals - Birds - Strigidae - Athene cunicularia
Animals - Crustaceans	Branchinecta lynchi	vernal pool fairy shrimp	ICBRA03030	Threatened	None	-	-	3712035	ATWATER	Mapped	Animals - Crustaceans - Branchinectidae - Branchinecta lynchi
Animals - Crustaceans	Linderiella occidentalis	California linderiella	ICBRA06010	None	None	-	-	3712035	ATWATER	Mapped	Animals - Crustaceans - Linderiellidae - Linderiella occidentalis
Animals - Mammals	Vulpes macrotis mutica	San Joaquin kit fox	AMAJA03041	Endangered	Threatened	-	-	3712035	ATWATER	Mapped	Animals - Mammals - Canidae - Vulpes macrotis mutica
Animals - Reptiles	Emys marmorata	western pond turtle	ARAAD02030	None	None	SSC	-	3712035	ATWATER	Mapped and Unprocessed	Animals - Reptiles - Emydidae - Emys marmorata
Plants - Vascular	Sagittaria sanfordii	Sanford's arrowhead	PMALI040Q0	None	None	-	1B.2	3712035	ATWATER	Mapped	Plants - Vascular - Alismataceae - Sagittaria sanfordii
Plants - Vascular	Atriplex persistens	vernal pool smallscale	PDCHE042P0	None	None	-	1B.2	3712035	ATWATER	Mapped	Plants - Vascular - Chenopodiaceae - Atriplex persistens
Plants - Vascular	Neostapfia colusana	Colusa grass	PMPOA4C010	Threatened	Endangered	-	1B.1	3712035	ATWATER	Mapped	Plants - Vascular - Poaceae - Neostapfia colusana

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Merced County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
San Joaquin Kit Fox *Vulpes macrotis mutica* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2873	Endangered

Reptiles

NAME	STATUS
Blunt-nosed Leopard Lizard *Gambelia silus* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/625	Endangered
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander *Ambystoma californiense* There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/8246	Endangered

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/498

Vernal Pool Tadpole Shrimp Lepidurus packardi — Endangered

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/2246

Flowering Plants

NAME	STATUS
Colusa Grass Neostapfia colusana There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5690	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20
Long-billed Curlew Numenius americanus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	Breeds elsewhere
Nuttall's Woodpecker Picoides nuttallii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9410	Breeds Apr 1 to Jul 20
Spotted Towhee Pipilo maculatus clementae This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/4243	Breeds Apr 15 to Jul 20
Whimbrel Numenius phaeopus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9483	Breeds elsewhere

Yellow-billed Magpie Pica nuttalli

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

https://ecos.fws.gov/ecp/species/9726

Breeds Apr 1 to Jul 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

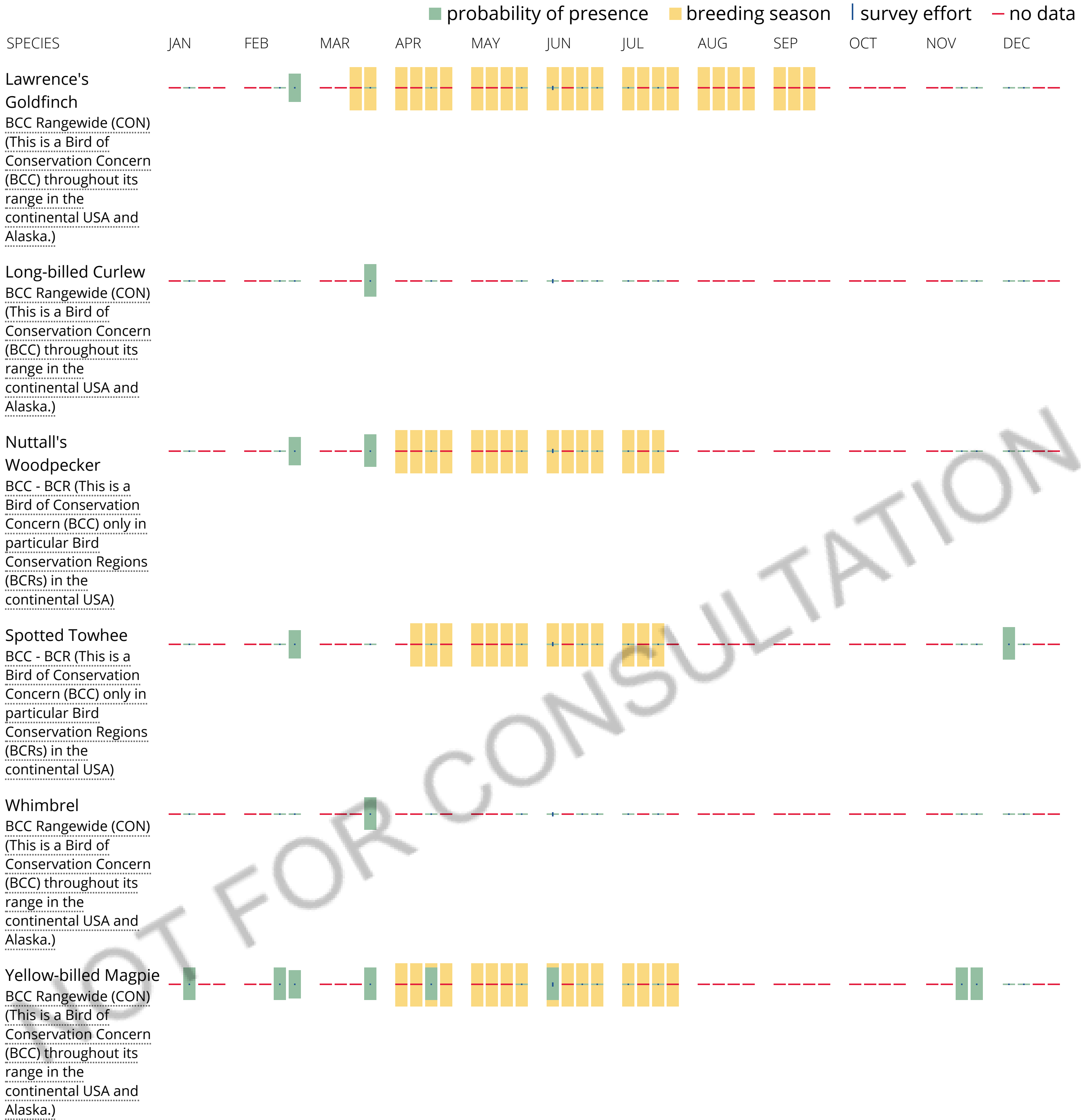
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE
- Riverine

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix C

Cultural Resources Reports:

California Historical Resources
Information System Records Search

Native American Heritage Commission
Sacred Lands File Search

CENTRAL CALIFORNIA INFORMATION CENTER
California Historical Resources Information System
Department of Anthropology – California State University, Stanislaus
One University Circle, Turlock, California 95382
(209) 667-3307

Alpine, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus & Tuolumne Counties

Date: 1/9/2020

Records Search File #: 11276 I
Project: Atwater Elementary School, NW corner of E. Juniper Avenue and Bridgewater Street, Atwater, Merced County, CA

Nicole Hoke, Associate Planner
O'Dell Planning & Research, Inc.
49346 Road 426, Suite 2
Oakhurst, CA 93644
559-472-7167

nicole@odellplanning.com

Dear Miss Hoke:

We have conducted a records search as per your request for the above-referenced project area located on the Atwater USGS 7.5-minute quadrangle map in Merced County.

Search of our files includes review of our maps for the specific project area and the immediate vicinity of the project area, and review of the following:

National Register of Historic Places (NRHP)
California Register of Historical Resources (CRHR)
California Inventory of Historic Resources (1976)
California Historical Landmarks
California Points of Historical Interest listing
Office of Historic Preservation Built Environment Resource Directory (BERD) and the Archaeological Determinations of Eligibility (ADOE)
Survey of Surveys (1989)
Caltrans State and Local Bridges Inventory
General Land Office Plats
Other pertinent historic data available at the CCaIC for each specific county

The following details the results of the records search:

Prehistoric or historic resources within the project area:

The project area is within the Merced Irrigation Historical District (P-24-001909), a district covering over 14 USGS quadrangles and that has been proposed but has not been officially recognized as a district or formally evaluated.

There are no formally recorded prehistoric or historic archaeological resources, or buildings or structures within the project area. However, we advise you that the current and 1960 editions of the Atwater USGS 7.5' quadrangle show an unnamed lateral of the Livingston Canal which has not been formally recorded. For your information, the Livingston Canal has been recorded as P-24-000552, and is a contributing element of the proposed Merced Irrigation District, and has been evaluated as not eligible for the National Register of Historic Places under the Section 106 process; it has not been evaluated for the California Register of Historical Resources or for Local Listing.

The General Land Office survey plat for T7S R13E (Sheet No. 44-476, dated 1853-1855) shows Section 6 divided into parcels of various acreages, but no historical features are referenced.

Prehistoric or historic resources within the immediate vicinity of the project area: None has been formally reported to the information Center.

Resources that are known to have value to local cultural groups: None has been formally reported to the Information Center.

Previous investigations within the project area: The project area has not been subject to a project-specific field investigation, but does fall within an archival study area report referenced below:

CCaIC #Report ME-06858

Holman, M., and R. Hellmann

2008 An Archival Study to Identify Potential Cultural Resources Located in the City of Atwater General Plan and Program EIR Project Area, Merced County, California. Holman & Associates.

Recommendations/Comments:

Please be advised that a historical resource is defined as a building, structure, object, prehistoric or historic archaeological site, or district possessing physical evidence of human activities over 45 years old. Since the project area has not been subject to previous investigations, there may be unidentified features involved in your project that are 45 years or older and considered as historical resources requiring further study and evaluation by a qualified professional of the appropriate discipline.

If ground disturbance during construction activities is considered a part of the current project, we recommend further review for the possibility of identifying Native American and historic-era archaeological resources.

If the proposed project contains buildings or structures that meet the minimum age requirement (such as the unnamed lateral of the Livingston Canal) it is recommended that the resource/s be assessed by a professional familiar with architecture and history of the county. Review of the available historic building/structure data has included only those sources listed above and should not be considered comprehensive.

If at any time you might require the services of a qualified professional the Statewide Referral List for Historical Resources Consultants is posted for your use on the internet at http://chrisinfo.org

If archaeological resources are encountered during project-related activities, work should be temporarily halted in the vicinity of the discovered materials and workers should avoid altering the materials and their context until a qualified professional archaeologist has evaluated the situation and provided appropriate recommendations. Project personnel should not collect cultural resources.

If human remains are discovered, California Health and Safety Code Section 7050.5 requires you to protect the discovery and notify the county coroner, who will determine if the find is Native American. If the remains are recognized as Native American, the coroner shall then notify the Native American Heritage Commission (NAHC). California Public Resources Code Section 5097.98 authorizes the NAHC to appoint a Most Likely Descendant (MLD) who will make recommendations for the treatment of the discovery.

We further advise you that if you retain the services of a historical resources consultant, the firm or individual you retain is responsible for submitting any report of findings prepared for you to the Central California Information Center, including one copy of the narrative report and copies of any records that document historical resources found as a result of field work, preferably in PDF format. If the consultant wishes to obtain copies of materials not included with this records search reply, additional copy or records search fees may apply.

Due to processing delays and other factors, not all of the historical resource reports and resource records that have been submitted to the State Office of Historic Preservation are available via this records search. Additional information may be available through the federal, state, and local agencies that produced or paid for historical resource management work in the search area. Additionally, Native American tribes have historical resource information not in the CHRIS Inventory, and you should contact the California Native American Heritage Commission for information on local/regional tribal contacts.

The California Office of Historic Preservation (OHP) contracts with the California Historical Resources Information System's (CHRIS) regional Information Centers (ICs) to maintain information in the CHRIS inventory and make it available to local, state, and federal agencies, cultural resource professionals, Native American tribes, researchers, and the public. Recommendations made by IC coordinators or their staff regarding the interpretation and application of this information are advisory only. Such recommendations do not necessarily represent the evaluation or opinion of the State Historic Preservation Officer in carrying out the OHP's regulatory authority under federal and state law.

We thank you for contacting this office regarding historical resource preservation. Please let us know when we can be of further service. Please sign and return the attached **Access Agreement Short Form.**

Note: Billing will be transmitted separately via email from the Financial Services office ($225.00), payable within 60 days of receipt of the invoice.

If you wish to include payment by Credit Card, you must wait to receive the official invoice from Financial Services so that you can reference the CMP # (Invoice Number), and then contact the link below:

https://commerce.cashnet.com/ANTHROPOLOGY

Sincerely,

EAGreathouse

E. A. Greathouse, Coordinator
Central California Information Center
California Historical Resources Information System

Copy of invoice to Laurie Marroquin, Financial Services (lamarroquin@csustan.edu)

CENTRAL CALIFORNIA INFORMATION CENTER
California Historical Resources Information System
Department of Anthropology – California State University, Stanislaus
One University Circle, Turlock, California 95382
(209) 667-3307

Alpine, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus & Tuolumne Counties

California Historical Resources Information System

ACCESS AGREEMENT SHORT FORM

Number: 11276I

I, the undersigned, have been granted access to historical resources information on file at the **Central California Information Center** of the California Historical Resources Information System.

I understand that any CHRIS Confidential Information I receive shall not be disclosed to individuals who do not qualify for access to such information, as specified in Section III(A-E) of the CHRIS Information Center Rules of Operation Manual, or in publicly distributed documents without written consent of the Information Center Coordinator.

I agree to submit historical Resource Records and Reports based in part on the CHRIS information released under this Access Agreement to the Information Center within sixty (60) calendar days of completion.

I agree to pay for CHRIS services provided under this Access Agreement within sixty (60) calendar days of receipt of billing.

I understand that failure to comply with this Access Agreement shall be grounds for denial of access to CHRIS Information.

Print Name: ______________________ Date: ______________

Signature: ______________________

Affiliation: ______________________

Address: City/State/Zip: ______________________
Billing Address (if different from above): ______________________

Telephone: __________ Fax: __________ Email: __________
Purpose of Access: ______________________

Reference (project name or number, title of study, and street address if applicable):
____

County: Township/Range/Section or UTMs: ______________________

USGS 7.5' Quad: ______________________

STATE OF CALIFORNIA Gavin Newsom, Governor

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone: (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

December 23, 2019

Nicole Hoke
Odell Planning & Research, Inc.

VIA Email to: nicole@odellplanning.com

RE: Juniper Elementary School Project, Merced County

Dear Ms. Hoke:

A record search of the Native American Heritage Commission (NAHC) Sacred Lands File (SLF) was completed for the information you have submitted for the above referenced project. The results were negative. However, the absence of specific site information in the SLF does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Attached is a list of Native American tribes who may also have knowledge of cultural resources in the project area. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated; if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call or email to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from tribes, please notify the NAHC. With your assistance, we can assure that our lists contain current information. If you have any questions or need additional information, please contact me at my email address: Nancy.Gonzalez-Lopez@nahc.ca.gov.

Sincerely,

Nancy Gonzalez Lopez

Nancy Gonzalez-Lopez
Staff Services Analyst

Attachment

Native American Heritage Commission
Native American Contact List
Merced County
12/23/2019

Amah MutsunTribal Band Valentin Lopez, Chairperson P.O. Box 5272 Galt, CA, 95632 Phone: (916) 743 - 5833 vlopez@amahmutsun.org	Costanoan Northern Valley Yokut
North Valley Yokuts Tribe Katherine Perez, Chairperson P.O. Box 717 Linden, CA, 95236 Phone: (209) 887 - 3415 canutes@verizon.net	Costanoan Northern Valley Yokut
Southern Sierra Miwuk Nation William Leonard, Chairperson P.O. Box 186 Mariposa, CA, 95338 Phone: (209) 628 - 8603	Miwok Northern Valley Yokut Paiute

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Juniper Elementary School Project, Merced County.

Appendix D

Geotechnical Engineering Investigation and

Geologic Seismic Hazards Evaluation

GEOTECHNICAL ENGINEERING INVESTIGATION AND GEOLOGIC SEISMIC HAZARDS EVALUATION

NEW ELEMENTARY SCHOOL - ATWATER
APN 004-010-026
ATWATER, MERCED COUNTY, CALIFORNIA 95301

BSK PROJECT G19-266-11F

PREPARED FOR:

ATWATER ELEMENTARY SCHOOL DISTRICT
1401 BROADWAY AVENUE
ATWATER, CALIFORNIA 95301

DECEMBER 4, 2019

GEOTECHNICAL ENGINEERING INVESTIGATION AND GEOLOGIC SEISMIC HAZARDS EVALUATION NEW ELEMENTARY SCHOOL - ATWATER APN 004-010-026 ATWATER, CALIFORNIA

Prepared for:

Atwater Elementary School District
1401 Broadway Avenue
Atwater, California 95301

BSK Project: G19-266-11F

December 4, 2019

Neva M. Popenoe, PE, GE
Senior Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
NEVA M. POPENOE
No. 3024
Exp. 06-30-21
GEOTECHNICAL
STATE OF CALIFORNIA

Martin B. Cline, PG, CEG
Senior Engineering Geologist

PROFESSIONAL GEOLOGIST
MARTIN B. CLINE
No. 2084
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

On Man Lau, PE, GE
South Valley Regional Manager

REGISTERED PROFESSIONAL ENGINEER
ON MAN LAU
No. 2644
Exp. 12-31-19
GEOTECHNICAL
STATE OF CALIFORNIA

BSK Associates
550 West Locust Avenue
Fresno, California 93650
(559) 497-2880
(559) 497-2886 FAX
www.bskassociates.com

BSK

Table of Contents

Figures

Appendices

1 INTRODUCTION

1.1 General

This report presents the results of the geotechnical engineering investigation and geologic/seismic hazards evaluation for the new elementary school in Atwater as shown on the Boring Location Map, Figure 2. The geotechnical engineering investigation and geologic/seismic hazards evaluation was conducted in general accordance with the scope of services outlined in BSK Proposal GF19-19185, dated November 6, 2019.

In the event that significant changes occur in the design or location of the proposed improvements, the conclusions and recommendations presented in the report will not be considered valid unless the changes are reviewed by BSK and the conclusions and recommendations are modified or verified in writing as necessary.

1.2 Project Description

We understand that this project consists of the design and construction of a new elementary school campus. We assume the new campus will include single-story wood or steel framed buildings. The location and associated square footage of the proposed improvements are not known at this time.

1.3 Purpose and Scope of Services

The purpose of the geotechnical investigation is to assess soil conditions at the project site and provide updated geotechnical engineering recommendations and geologic/seismic hazards evaluations for use by the project designers during preparation of the project plans and specifications. The scope of the investigation included a field exploration, laboratory testing, engineering analysis, and geologic seismic hazards evaluations.

The investigation was performed in conformance with Division 1, Chapter 13, Subchapter 1 of Title 5 California Code of Regulations and Title 24, California Code of Regulations, for submission to Division of the State Architect.

2 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 Field Investigation

The field exploration, conducted on December 21, 2018 consisted of a site reconnaissance and hand auguring four (4) exploratory test borings. The test borings were excavated, within the area of the proposed improvements with a truck mounted drill rig equipped with 8-inch hollow stem augers to depths of approximately 16.5 to 51.5 feet below ground surface (bgs). The approximate boring locations are presented on Figure 2, Boring Location Map. Details of the field exploration and the boring logs are provided in Appendix A.

2.2 Laboratory Testing

Laboratory testing of selected samples were performed to evaluate their physical and engineering characteristics and properties. The testing program included in-situ moisture and dry density, percent passing the No. 200 sieve, and corrosion potential.

The in-situ moisture, dry density, and percent passing the No. 200 sieve test results are presented on the boring logs in Appendix A. Descriptions of the laboratory test methods and remaining test results are provided in Appendix B.

3 SITE CONDITIONS

3.1 Site Description

At the time of the field investigation the project site was undeveloped and contained seasonal weeds and grasses. The general site coordinates are approximately 37.3506° North Latitude and 120.5869° West Longitude. The project site was bounded to the west by residential buildings, to the north by a park, to the east by Bridgewater Street, and to the south by East Juniper Avenue. The site location is generally surrounded by residential.

3.2 Subsurface Description

The near surface soils encountered within the test borings consisted of fine to medium-grained silty sand in the upper 5 to 15 feet bgs underlain by sandy clay, sandy silt, poorly graded sand, and silty sand to the maximum depth of exploration, 51.5 feet bgs. The boring logs in Appendix A provide a more detailed description of the soils encountered in each boring, including the applicable Unified Soil Classification System symbols.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

Based upon the data collected during this investigation and from a geotechnical engineering standpoint, it is our opinion that there are no soil conditions that would preclude the construction of the proposed improvements.

4.2 Soil Corrosivity

Based on test results, on-site, near-surface soils have low soluble sulfate and chloride contents, a moderate minimum resistivity, and are slightly acidic. Thus, on-site soils are considered to have a low corrosion potential with respect to buried concrete and a moderate corrosive potential for unprotected metal conduits.

We recommend that Type I/Type II cement be used in the formulation of concrete, and that buried reinforcing steel protection be provided with a minimum concrete cover required by the American Concrete Institute (ACI) Building Code for Structural Concrete, ACI 318, Chapter 7.7. Buried metal conduits must have protective coatings in accordance with the manufacturer's specifications. If detailed recommendations for corrosion protection are desired, a corrosion specialist must be consulted.

5 LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the current investigation at locations shown on figure 2 and data presented in the referenced reports. 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 additional exploration and testing is performed or 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.

The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Merced County at the time the report was written. No other warranties either express or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

FIGURES

REFERENCE IMAGE: Google Earth

ASSOCIATES
550 West Locust Avenue
Fresno, California 93650
Tel. (559) 497-2880

SITE VICINITY MAP

New Atwater Elementary
E Juniper Avenue and Bridgewater St
Atwater, California

FIGURE 1

JOB NO. G19-266-11F
DATE November 18, 2019
DR. BY TG
CH. BY NP
SCALE AS SHOWN
SHEET NO. 1
OF 1 SHEETS

P:\FRS\Active\GEO\G1926611F – Geologic Seismic Hazard – Atwater Elem\Graphics\G19-266-11F.dwg User:tgonzalez Plotted:Nov 18, 2019 – 12:14pm Last Save:Oct 28, 2019 – 10:48am

P:\FRS\Active\GEO\G1926611F - Geologic Seismic Hazard - Atwater Elem\Graphics\G19-266-11F.dwg User:tgonzalez Plotted:Nov 18, 2019 - 12:13pm Last Save:Oct 28, 2019 - 10:48am

LEGEND:

B- 4 APPROXIMATE BORING LOCATIONS

BSK ASSOCIATES
550 West Locust Avenue
Fresno, California 93650
Tel. (559) 497-2880

BORING LOCATION MAP

New Atwater Elementary
E Juniper Avenue and Bridgewater St
Atwater, California

FIGURE 2

JOB NO.	G19-266-11F
DATE	November 18, 2019
DR. BY	TG
CH. BY	NP
SCALE AS SHOWN	
SHEET NO.	1
OF	1 SHEETS

APPENDIX A
FIELD EXPLORATION

APPENDIX A
Field Exploration

The field exploration was conducted on November 15, 2019, under the oversight of a BSK staff engineer. Four (4) test borings were excavated to a depth of between 16.5 and 51.5 feet below existing ground surface (bgs) within the proposed building area. The borings were excavated with a truck mounted drill rig equipped with 8-inch hollow stem augers. The approximate location of the test borings are presented on Figure 2, Boring Location Map.

The soil materials encountered in the test borings were visually classified in the field and logs were recorded during the excavation and sampling operations. Visual classification of the materials encountered in the test borings were made in general accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions.

Subsurface samples were obtained at the various depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) lined with stainless sleeves and 1.4-inch I.D. Standard Penetration Test (SPT) sampler. The samplers were driven 18 inches using a 140-pound, automatic hammer dropping 30 inches. The number of blows required to drive the last 12 inches was recorded as the blow count (blows/foot) on the log of borings. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Disturbed soil samples were obtained using the Split-Spoon Sampler (marked X in logs) and were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the soil cuttings, as set forth in BSK's proposal.

It should be noted that the use of terms such as "soft", "medium stiff", "very stiff" or "hard" 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 sieve	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, POOORLY 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

	Modified California	RV	R-Value
	Standard Penetration Test (SPT)	SA	Sieve Analysis
	Split Spoon	SW	Swell Test
	Pushed Shelby Tube	TC	Cyclic Triaxial
	Auger Cuttings	TX	Unconsolidated Undrained Triaxial
	Grab Sample	TV	Torvane Shear
	Sample Attempt with No Recovery	UC	Unconfined Compression
CA	Chemical Analysis	(1.2)	(Shear Strength, ksf)
CN	Consolidation	WA	Wash Analysis
CP	Compaction	(20)	(with % Passing No. 200 Sieve)
DS	Direct Shear		Water Level at Time of Drilling
PM	Permeability		Water Level after Drilling(with date measured)
PP	Pocket Penetrometer		

SOIL CLASSIFICATION CHART AND LOG KEY

BSK ASSOCIATES

BSK ASSOCIATES

BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-1**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
0								SM	**Silty SAND** - light brown, moist, medium dense, fine to medium grained sand	
2			26	108.3	0.9					
6			31							
11			43	116.4	5.2				... slight decrease in silt content	
13.5								ML	**Sandy SILT** - reddish brown, moist, hard, fine to medium grained sand	
16			50/ 5"							
20									... decrease in red color, slight increase in sand content	
21			50/ 5"	114.0	13.6					
24								SM	**Silty SAND** - light brown, moist, very dense, fine to medium grained sand	

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

BSK ASSOCIATES
BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-1**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
26			50						**Silty SAND** - light brown, moist, very dense, fine to medium grained sand *(continued)*	
27										
28										
29										
30										
31			64	104.8	11.1				... dense, increase in fine grained sand	
32										
33										
34										
35								SP	**Poorly Graded SAND** - pale brown, moist, medium dense to dense, fine sand, trace silt or clay	
36			21			27				
37										
38										
39										
40										
41			45	98.3	4.5					
42										
43										
44										
45										
46			15			30				
47										
48										
49										

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-1**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
51			50/ 5"					CL	**CLAY** - grayish brown, moist, hard, trace fine sands	
52									Boring terminated at approximately 51.5 feet bgs. No groundwater encountered. Boring backfilled with soil cuttings.	
53										
54										
55										
56										
57										
58										
59										
60										
61										
62										
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

BSK ASSOCIATES

BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-2**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
								SM	**Silty SAND** - light brown, moist, medium dense, fine to medium grained	
1										
2										
3			33							
4										
5										
6			43	107.9	9.9				... light gray, trace clay	
7										
8										
9										
10									...brown, medium dense, no trace clay	
11										
12										
13										
14										
15								CL	**Sandy CLAY** - brown, moist, hard, fine grained sand, white striations	
16										
17										
18										
19								SM	**Silty SAND** - brown, moist, dense, fine to medium grained sand, trace clay	
20										
21										
22										
23									Boring terminated at approximately 21.5 feet bgs. No groundwater encountered. Boring backfilled with soil cuttings.	
24										

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/19/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 6.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

GEO BORING LOGS.GPJ BSK.GDT 11/26/19

BSK ASSOCIATES
BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-3**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
0–2								SM	**Silty SAND** - brown, moist, medium dense to dense, fine to medium grained	
2–3.5			50/ 5"							
5–6.5			32							
10–11.5			38							
15–16.5			50/ 3"	114.0	10.4				... reddish brown	
16.5									Boring terminated at approximately 16.5 feet bgs. No groundwater encountered. Boring backfilled with soil cuttings.	

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 16.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

BSK ASSOCIATES
BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-4**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
0–5			35					SM	**Silty SAND** - light brown, moist, medium dense, fine to medium grained	
5–10			50					ML	**SILT** - gray/white, moist, hard, with fine grained sand	
10–15			28					ML	**Sandy SILT** - light grayish brown, moist, very stiff, fine grained sand	
15–20			31					SM	**Silty SAND** - brown, moist, dense, fine to medium grained	
20–			50/ 4"						... reddish brown	

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 31.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

BSK ASSOCIATES
BSK Associates
550 W. Locust Ave.
Fresno, CA 93650
Telephone: 559-497-2880
Fax: 559-497-2886

Project: Atwater Elementary School
Location: Atwater, CA
Project No.: G19-266-11F
Logged By: F. Gomez
Checked By: N. Popenoe

Boring: **B-4**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
26			50/ 3"						**Silty SAND** - brown, moist, dense, fine to medium grained *(continued)* ... brown, with clay	
27										
28										
29										
30										
31			50/ 6"							
32									Boring terminated at approximately 31.5 feet bgs. No groundwater encountered. Boring backfilled with soil cuttings.	
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										

Drilling Contractor: Baja Exploration
Drilling Method: Hollow Stem Auger
Drilling Equipment: Mobile B-61
Date Started: 11/15/19
Date Completed: 11/15/19

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 31.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

APPENDIX B
LABORATORY TESTING

APPENDIX B
Laboratory Testing

The results of laboratory testing performed in conjunction with this project are contained in this Appendix. The following laboratory tests were performed on soil samples in general conformance with applicable standards.

In-Situ Moisture and Density

The field moisture content and in-place dry density determinations were performed on a relatively undisturbed samples obtained from the test borings. 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 D2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in accordance with ASTM D2937 test procedures. Test results are presented on the boring logs in Appendix A.

Percent Passing No. 200 Sieve Test

Two (2) samples were tested for percent passing the number 200 sieve test. The test was performed in general accordance with Test Method ASTM D1140. The results of the tests are presented on the boring logs in Appendix A.

Soil Corrosivity

The results of chemical analyses performed on a bulk soil sample using CT 643 (for minimum resistivity and PH) and CT 417 and 422 (for soluble sulfate and chlorides, respectively).

SUMMARY OF CHEMICAL TEST RESULTS

Sample Location	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Minimum Resistivity (ohms-cm)
B-3 @ 0 – 6”	6.9	4.1	Not detected	11,920

APPENDIX C

Geologic/Seismic Hazard Evaluation
New Elementary School Campus
Atwater Elementary School District
APN 004-010-026
Atwater, California

BSK G19-266-11F

December 4, 2019

GEOLOGIC/SEISMIC HAZARD EVALUATION
PROPOSED NEW SCHOOL SITE APN 004-010-026
ATWATER ELEMENTARY SCHOOL DISTRICT
ATWATER, CALIFORNIA

Table of Contents

Figures

C1. INTRODUCTION

This report presents the geologic and seismic hazards assessment prepared in accordance with the 2016 California Building Code (CBC), CCR Title 24, Chapters 16A and 18A requirements for a Geotechnical/Engineering Geologic Report. The assessment was performed in conformance with California Geological Survey (CGS) Note 48 (2013). Items contained in this report are presented to satisfy the requirements of Title 5, CCR, Division 1, Chapter 13, Subchapter 1, School Facilities Construction related to Section 14011(g).

C1.1 Purpose and Scope of Services

The purpose of the geologic and seismic hazards assessment is to provide the Client with an evaluation of potential geologic or seismic hazards which may be present at the site or due to regional influences. BSK's scope of services for this assessment included the following:

1. Review of published geologic literature, and current and past investigations at the site;
2. Evaluation of the data collected and preparation of geologic cross sections;
3. Evaluation of potential geologic hazards affecting the site;
4. Determination of Site Class and seismic design parameters.

The observations and conclusions presented in this report specifically exclude the assessment of environmental characteristics, particularly those involving hazardous substances, and a high-pressure pipeline risk evaluation.

C1.2 Site Location

The proposed new school site located at the northwest corner of Juniper Road and Bridgewater Street, in Merced, California, APN 004-010-026 (Site)
The center of the Site coordinates are:

Latitude 37.350665ºN
Longitude 120.586859ºW

The surrounding area mostly consists of residential housing. The adjacent properties are residential with a park located north of the Site. The Site is currently not developed vacant adjacent properties to the west are residential with some farmland.

C1.3 Site Topography

As shown on Figure C-1, the site and surrounding area topography is relatively flat with a ground surface elevation of approximately 155 feet, USGS datum.

C1.4 Groundwater Conditions

The Site is within the Merced sub-basin of 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 observed at the time of our borings were completed to depths of 51.5 feet below the ground surface (bgs). Please note that the groundwater level may fluctuate both seasonal and from year to year due to variations in rainfall, temperature, pumping from wells and possibly as the result of other factors that were not evident at the time of our investigation.

To ascertain groundwater levels for the area during other time periods, groundwater elevation data from the California Department of Water Resources (DWR) were obtained for the period 1960 to 2015. The water level hydrograph from two wells are presented on Figure C-2. The hydrograph indicates that the highest historic groundwater elevation in the general area of the site was approximately 142 feet in the 1960s. Using a Site elevation of 155 feet, the shallowest historic depth to groundwater was approximately 13 feet bgs.

C2.0 GEOLOGIC SETTING

The site is located in the Great Valley geomorphic province. The area lies within 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. East of the site, the relatively flat geomorphology transitions into the foothills of Sierra Nevada, which generally consist of pre-Cretaceous metamorphic rocks and Mesozoic granitic rocks.

As shown on Figure C-3, the site is situated on Pleistocene Modesto Formation that are the result of older alluvial fans derived from the Sierra Nevada Mountain Range to the east.

Nearby active faults include the Great Valley Fault located approximately 25 miles west of the site, the Ortigalita Fault located approximately 34 miles west of the Site, and the Greenville Fault located approximately 47 miles west of the Site.

C2.1 Subsurface Conditions

Subsurface conditions are described in the 2019 geotechnical investigation report prepared by BSK Associates (BSK) and to which this geologic and seismic hazards report is appended. The site was the subject of a current field investigation of four soil borings completed to a maximum depth of approximately 51.5 feet bgs. The locations of the soil borings are presented on Figure C-4, Site Map. The soil unit present at the site are predominately silty sand with some layers of sandy silt. Poorly graded sand was encountered at a depth of 35 feet bgs and clay was encountered at 50 feet bgs. A cross section presenting the subsurface conditions in the proposed improvement area is presented on Figure C-5, Geologic Cross Section.

C3.0 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.

C3.1 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. The closest Fault-Rupture Hazard Zone is associated with the Ortigalita Fault, approximately 34 miles west of the Site.

C3.2 State of California Seismic Hazard Zones (Liquefaction and Landslides)

Zones of Required Investigation referred to as "Seismic Hazard Zones" (SHZ) in CCR Article 10, Section 3722, are areas shown on Seismic Hazard Zone Maps where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements.

The site is within the Atwater 7.5 Minute Quadrangle and there are no mapped areas that have Seismic Hazard Zones in the project area.

C3.3 Slope Stability and Potential for Slope Failure

The project area is essentially flat and the potential hazard due to landslides from adjacent properties is not applicable.

C3.4 Flood and Inundation Hazards

An evaluation of flooding at the site includes review of potential hazards from flooding during periods of heavy precipitation and flooding due to a catastrophic dam breach from up-gradient surface impoundments.

C3.4.1 Flood Hazards

Federal Emergency Management Agency (FEMA) flood hazard data was obtained to present information regarding the potential for flooding at the Site. As shown on Figure C-6, the Site lies in Zone X, an area of minimal flooding outside the 500-year and 100-year floodplains (FEMA D-Firm GIS data, dated 3/5/2015).

C3.4.2 Inundation Hazards - Dams

As shown on Figure C-7, the Site is located in the pathway of inundation from a catastrophic breach the Lake Yosemite dam (Dam Inundation GIS data from California Emergency Management Agency, dated 2013).

C3.5 Volcanic Hazards

According to USGS Bulletin 1847, dated 1989, the site is not located in an area which would be subject to hazards from volcanic eruptions (Miller, 1989).

C3.6 Corrosion

Please refer to the section titled "Corrosion Assessment" in the geotechnical report for discussion of the corrosivity of the site soils.

C3.7 Expansive Soils

As discussed in the geotechnical report, the near-surface soils encountered within the current borings throughout the site are silty sand which exhibit a low to non-expansion potential

C3.8 Land Subsidence

Four types of subsidence are known to occur in the San Joaquin Valley (Galloway, 1999). In order of decreasing magnitude, they are:

(1) Subsidence caused by aquifer system compaction due to the lowering of ground-water levels by sustained ground-water overdraft;

(2) Subsidence caused by the hydrocompaction of moisture-deficient deposits above the water table;

(3) Subsidence related to fluid withdrawal from oil and gas fields; and

(4) Subsidence related to crustal neotectonic movements.

The site is not located in an area known to be susceptible to subsidence due to petroleum or groundwater withdrawal. The area south of Merced, approximately seven miles south the Site is mapped as a subsidence area (USGS, 2018). Due to the distance the subsidence in that area would not impact the Site. The site is not located in an area in which soils are known to be impacted by hydrocompaction.

C4. SEISMIC HAZARD ASSESSMENT

C4.1 Seismic Source Deaggregation

Figures C-8 presents fault maps showing the major faults that may impact the site in the future. Seismically induced 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 determination, at the maximum considered earthquake (MCE) hazard level, results in distance, magnitude and epsilon (ground-motion uncertainty) for each source that 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.

Deaggregation based on a probabilistic model developed by the USGS indicates that the extreme seismic source with the highest magnitude that contributes to the peak ground acceleration (PGA) is a magnitude 8.03 earthquake from the San Andreas Fault. For liquefaction and seismic settlement, the modal magnitude (Mw) of 6.71 would be appropriate for probabilistic input parameter that is consistent with the design earthquake ground motion.

C4.2 Historical Seismicity

Table C-1 provides the location, earthquake magnitude, site to earthquake distances, dates and the resulting site peak horizontal acceleration for the period 1800 to 2016. Figure C-8 presents historical earthquake magnitudes and locations relative to the site.

TABLE C-1
HISTORIC EARTHQUAKES WITHIN 100 MILES OF THE SITE
GROUND MOTION GREATER THAN 0.05G

File Code	Latitude (North)	Longitude (West)	Date	Depth (km)	Earthquake Magnitude	Site Acceleration (g)	Distance mi (km)
T-A	36.830	121.570	10/18/180	0	7.0	0.11	65.0(104.6)
GSB	37.036	121.883	10/18/198	18.5	7.0	0.10	74.5(119.9)
DMG	37.250	121.750	7/1/1911	0	6.6	0.09	64.3(103.4)
DMG	37.500	121.300	07/15/186	0	5.8	0.08	40.4(65.1)
DMG	37.400	121.400	04/10/188	0	5.9	0.08	44.7(72.0)
DMG	37.000	121.500	06/20/189	0	6.2	0.08	55.8(89.7)
BRK	36.220	120.290	5/2/1983	0	6.7	0.08	79.8(128.4)
DMG	37.700	122.100	10/21/186	0	6.8	0.08	86.3(138.9)
GSB	37.320	121.698	4/24/1984	8	6.2	0.07	61.0(98.2)
DMG	36.900	121.200	03/06/188	0	5.7	0.07	45.9(73.9)
DMG	37.200	121.500	07/06/189	0	5.8	0.07	51.2(82.4)
DMG	37.300	121.900	10/08/186	0	6.3	0.07	72.2(116.2)
BRK	37.100	121.500	8/6/1979	0	5.8	0.07	53.1(85.4)
DMG	36.400	121.000	04/12/188	0	6.2	0.07	69.5(111.8)
DMG	36.900	121.600	04/24/189	0	6.0	0.06	63.9(102.8)
DMG	37.100	121.700	02/26/186	0	5.9	0.06	63.6(102.3)
DMG	37.500	121.900	11/26/185	0	6.1	0.06	72.7(117.0)
PAS	37.556	118.791	5/25/1980	6.4	6.5	0.06	99.4(160.0)
GSB	36.810	121.275	1/26/1986	7	5.5	0.06	53.2(85.6)
GSB	37.483	121.690	3/31/1986	8	5.7	0.06	61.2(98.4)
PAS	37.608	118.821	5/25/1980	3.7	6.4	0.06	98.4(158.3)

The Table C-1 shows that the site has experienced mean plus one sigma peak horizontal acceleration up to 0.11g from the 7.0 magnitude Mission San Juan Bautista earthquake. In general, the site has been subjected to relatively low intensity ground motion, primarily from large earthquakes on distance faults and low magnitude earthquakes closer to the site.

C4.3 Earthquake Ground Motion, 2016 California Building Code

C4.3.1 Site Class

Based on Section 1613A.3.2 of the 2016 California Building Code (CBC), the Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-10. Based on the “N” values from our soil borings, as per Table 20.3-1 of ASCE 7-10, the Site is Class D (15 ≤ N ≤50).

C4.3.2 Seismic Design Criteria

The 2016 California Building Code (CBC) utilizes ground motion based on the Risk-Targeted Maximum Considered Earthquake (MCE_R) that is define in the 2016 CBC as the most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk. Ground motion parameters in the 2016 CBC are based on ASCE 7-10, Chapter 11.

The United States Geologic Survey (USGS) has prepared maps presenting the Risk-Targeted MCE spectral acceleration (5% damping) for periods of 0.2 seconds (SS) and 1.0 seconds (S1). The values of SS and S1 can be obtained from the OSHPD Seismic Design Maps Application available at:
https://seismicmaps.org/

Table C-2 below presents the spectral acceleration parameters produced for Site Class D by the OSHPD Ground Motion Parameter Application and Chapter 16 of the 2016 CBC based on ASCE 7-10.

TABLE C-2
SPECTRAL ACCELERATION PARAMETERS
RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE

Criteria	Value		Reference
MCE Mapped Spectral Acceleration (g)	S_S = 0.690	S_1 = 0.283	USGS Mapped Value
Site Coefficients (Site Class D)	F_a = 1.248	F_v = 1.834	ASCE Table 11.4
Site Adjusted MCE Spectral Acceleration (g)	S_{MS} = 0.861	S_{M1} = 0.519	ASCE Equations 11.4.1-2
Design Spectral Acceleration (g)	S_{DS} = 0.574	S_{D1} = 0.346	ASCE Equations 11.4.3-4

C4.3.3 Seismic Design Category

As shown above, the short period design spectral response acceleration coefficient, SDS, is greater than 0.50, therefore the Site lies in Seismic Design Category D as specified in Section 1613A.3.5 of the 2016 CBC . The long period spectral response acceleration coefficient, S1, is less than 0.75, therefore the Site lies in Seismic Design Category D, based on Risk Category III. When S1 is greater than or equal to 0.75g, the Seismic Design Category is E for buildings in Risk Categories I, II, and III, and F for those in Risk Category IV.

C4.3.4 Geometric Mean Peak Ground Acceleration

As per Section 1803A.5.12 of the CBC, peak ground acceleration (PGA) utilized for dynamic lateral earth pressures and liquefaction, shall be based on a site specific study (ASCE 7-10, Section 21.5) or ASCE 7-10, Section 11.8.3. The USGS Ground Motion Parameter Application based on ASCE 7-10, Section 11.8.3 produced the values shown in Table C-3 based on Site Class D.

TABLE C-3 GEOMETRIC MEAN PEAK GROUND ACCELERATION MAXIMUM CONSIDERED EARTHQUAKE		
Criteria	**Value**	**Reference**
Mapped Peak Ground Acceleration (g)	PGA = 0.242	USGS Mapped Value
Site Coefficients (Site Class D)	F_{PGA} = 1.316	ASCE Table 11.8-1
Geometric Mean PGA (g)	PGA_M = 0.318	ASCE Equations 11.8-1

C4.4 Seismically Induced Ground Failure

C4.4.1 Liquefaction

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.

In order for liquefaction triggering to occur due to ground shaking, it is generally accepted that four conditions will exist:

1. The subsurface soils are in a relatively loose state
2. The soils are saturated
3. The soils have low plasticity
4. Ground shaking is of sufficient intensity to act as a triggering mechanism

We estimate the historical depth to groundwater is 13 feet bgs. A liquefaction/seismic settlement analysis was performed using the program Liquefy Pro version 5.8k using boring data from boring B-1

Input parameters for the liquefaction and settlement analysis were based upon:

- Soil densities estimated from soil boring data
- PGA based upon the geometric mean peak ground acceleration or 0.318g.
- Magnitude 6.71 of controlling earthquake from Deaggregation of the seismic hazard.
- Assumed depth to groundwater of 13 feet bgs from historical high.
- A Factor-of-Safety of 1.3 was used for analysis.

The results of our liquefaction and seismic settlement analysis based upon data from soil boring B-2 is provided on Figure C-9. Based on our liquefaction analysis, the liquefaction may occur in some of the sandy units below a depth of 35 feet bgs during the design earthquake.

C4.4.2 Lateral Spread

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. Sloped ground or channel free-faces are not present in the area, therefore the potential for lateral spreading to take place at the site is low.

C4.4.3 Dynamic Compaction/Seismic Settlement

Another type of seismically induced ground failure, which can occur as a result of seismic shaking, is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils.

A seismic settlement analysis was performed using the program Liquefy Pro version 5.8k using soil boring data B-1. Input parameters for the liquefaction and settlement analysis were based upon:

- Soil densities and fines content estimated from boring data
- PGA based upon the geometric mean peak ground acceleration or 0.318g.
- Magnitude 6.71 of controlling earthquake from Deaggregation of the seismic hazard.
- Assumed depth to groundwater of 13 feet bgs from historical high.
- A Factor-of-Safety of 1.3 was used for analysis.

Based on the analysis the total seismic settlement is estimated to be 1.1 inch with a differential settlement of 0.6 inch over 30 feet.

C5. REFERENCES

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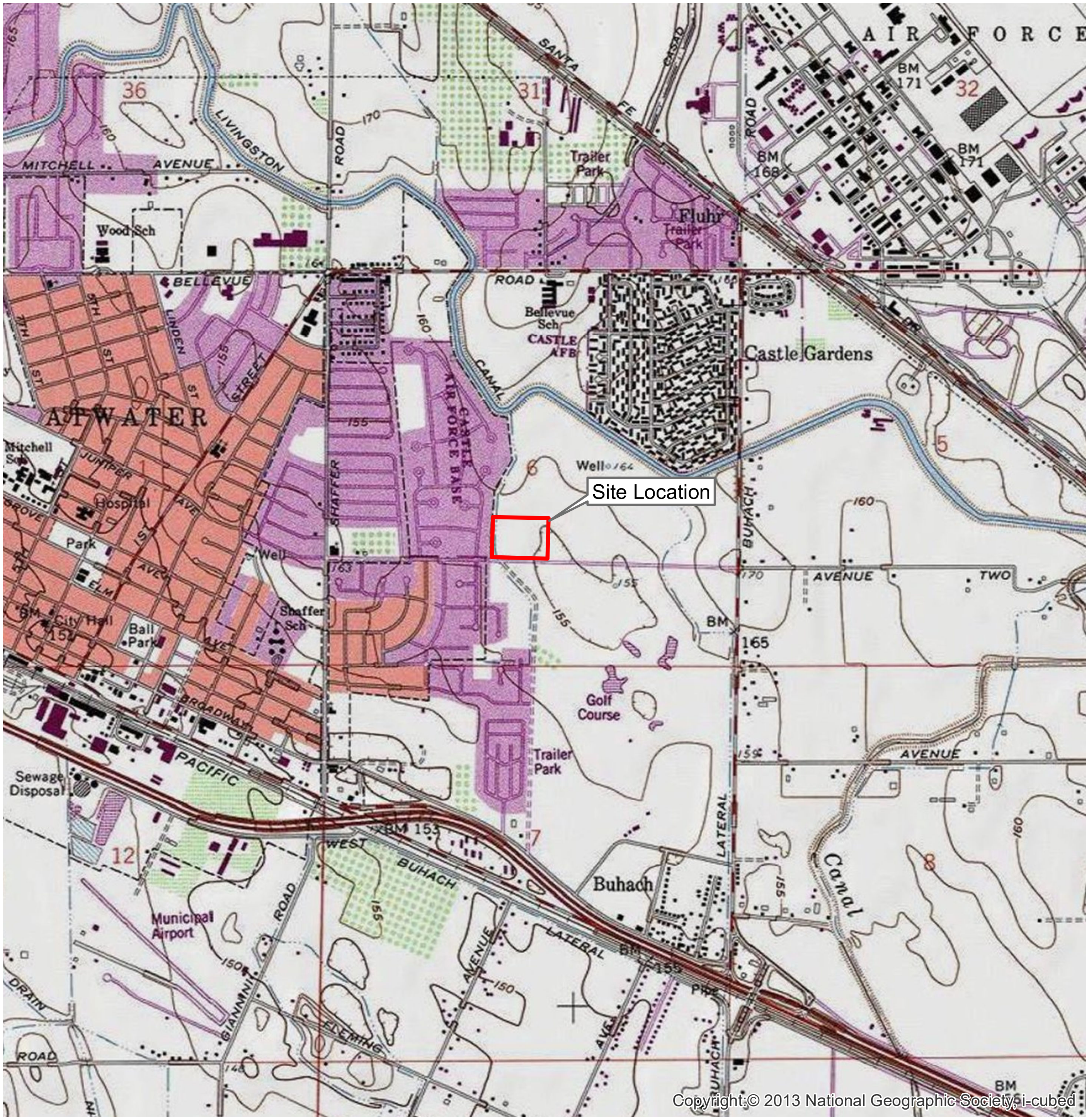

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Reference: http://atlas.ca.gov/quads/

Map Date: 11/25/2019

Document Path: T:\GIS-Files\Project-Files\Geotech\G1926611F - New Atwater Elementary School\Figure C-1 Topomap.mxd

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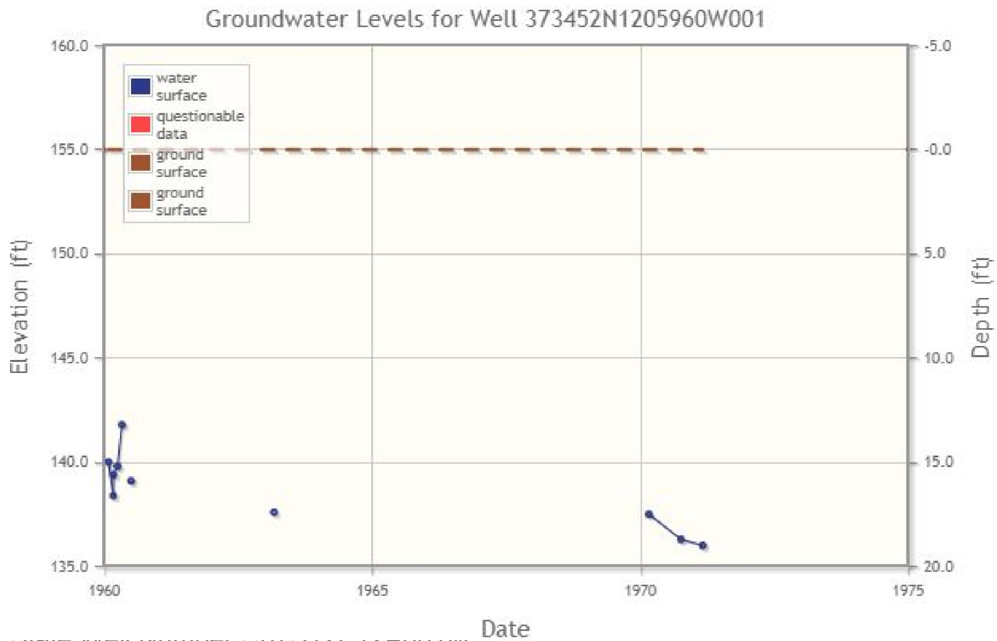
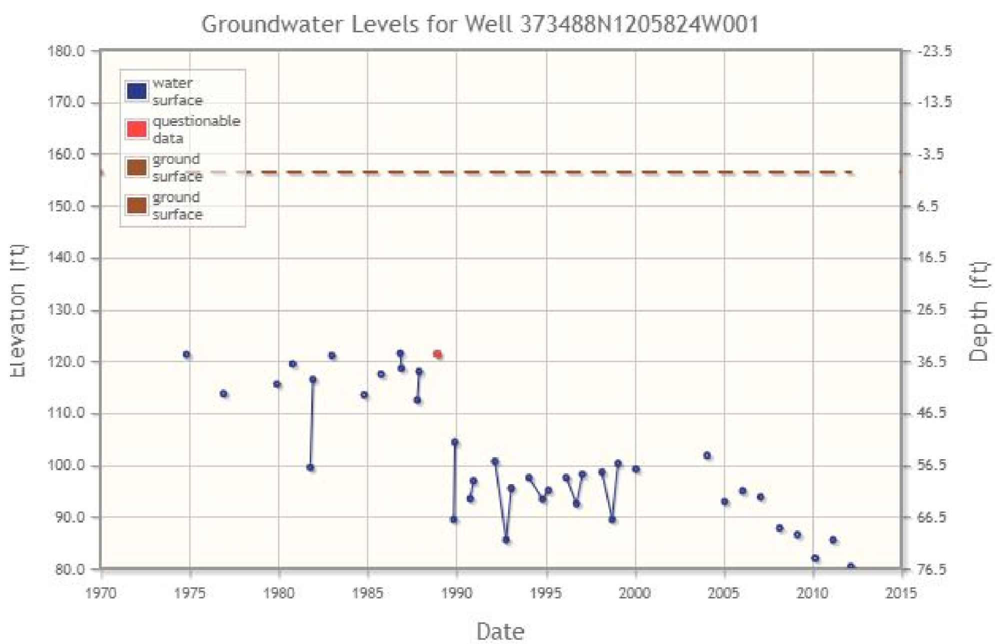
Geologic/Seismic Hazard Evaluation Proposed New School Site APN 004-010-026 Atwater Elementary School District Atwater, California	Figure C-1 Topographic Map BSK Project G1926611F



State Well Number: 07S12E12A001M
Site Code: 373452N1205960W001
Latitude (NAD83): 37.345200
Longitude (NAD83): -120.596
Groundwater Basin (code): Merced (5-022.04)
Reference Point Elevation (NAVD88 ft): 155.470
Ground Surface Elevation (NAVD88 ft): 154.97



Site Code: 373488N1205824W001
Latitude (NAD83): 37.348800
Longitude (NAD83): -120.5824
Groundwater Basin (code): Merced (5-022.04)
Reference Point Elevation (NAVD88 ft): 157.480
Ground Surface Elevation (NAVD88 ft): 156.480

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Map Date: 11/25/2019

Reference: http://www.water.ca.gov/waterdatalibrary/index.cfm

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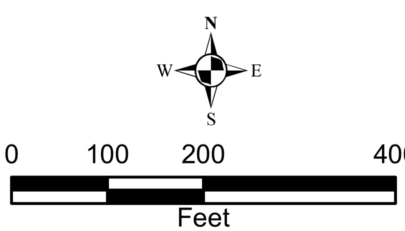
BSK ASSOCIATES	Geologic/Seismic Hazard Evaluation Proposed New School Site APN 004-010-026 Atwater Elementary School District Atwater, California	Figure C-2 Area Hydrographs BSK Project G1926611F



Legend

- Project Area
- Boring Location
- Cross Section Line

Map Date: 11/25/2019

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Geologic/Seismic Hazard Evaluation Proposed New School Site APN 004-010-026 Atwater Elementary School District Atwater, California	Figure C-3 Site Map BSK Project G1926611F

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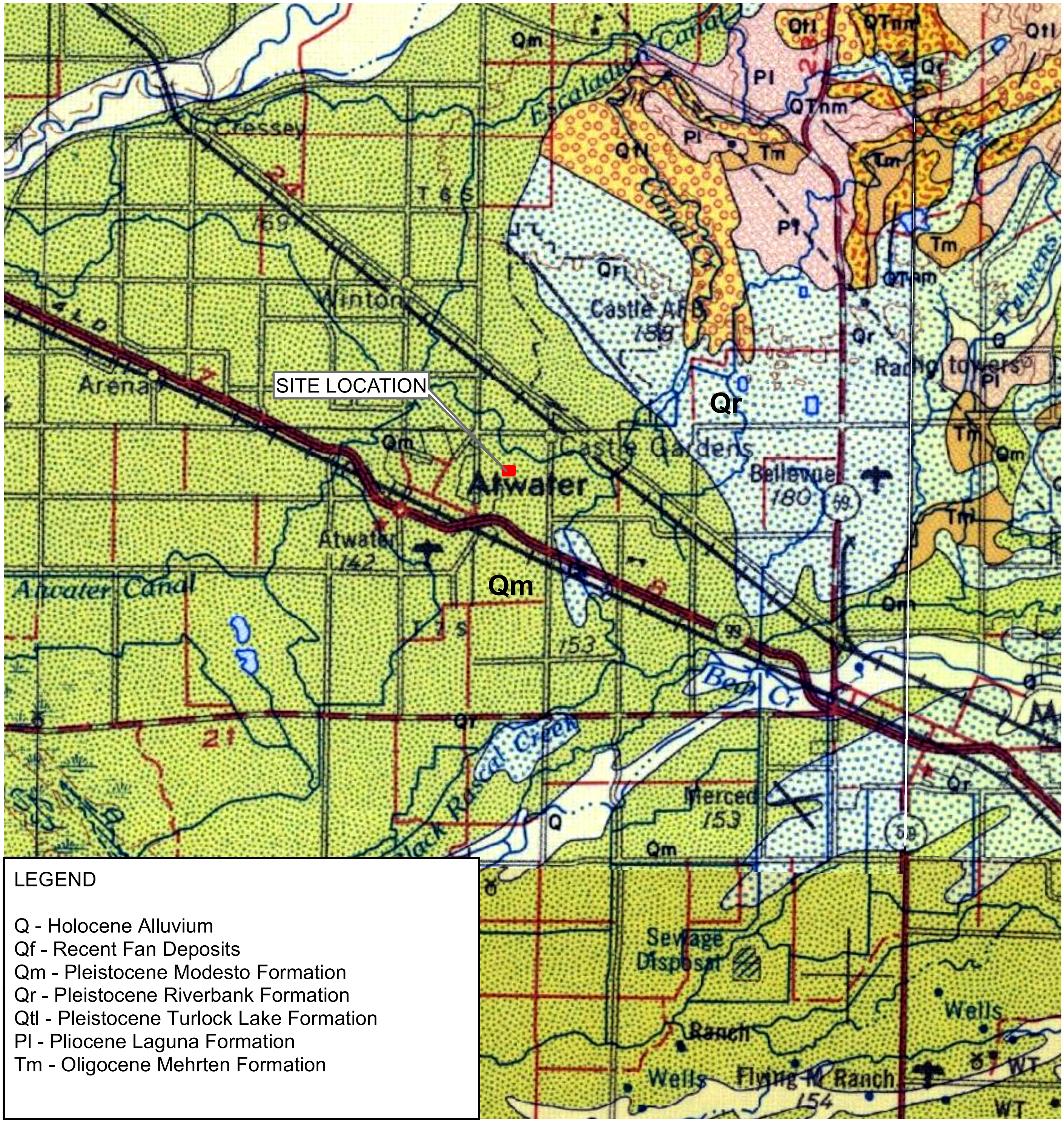

LEGEND

Q - Holocene Alluvium
Qf - Recent Fan Deposits
Qm - Pleistocene Modesto Formation
Qr - Pleistocene Riverbank Formation
Qtl - Pleistocene Turlock Lake Formation
Pl - Pliocene Laguna Formation
Tm - Oligocene Mehrten Formation

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Reference: Wagner, D.L., Bortugno, E.J., and McJunkin, R.D., 1991, Geologic map of the San Francisco-San Jose quadrangle, California, 1:250,000: California Division of Mines and Geology, Regional Geologic Map 5A

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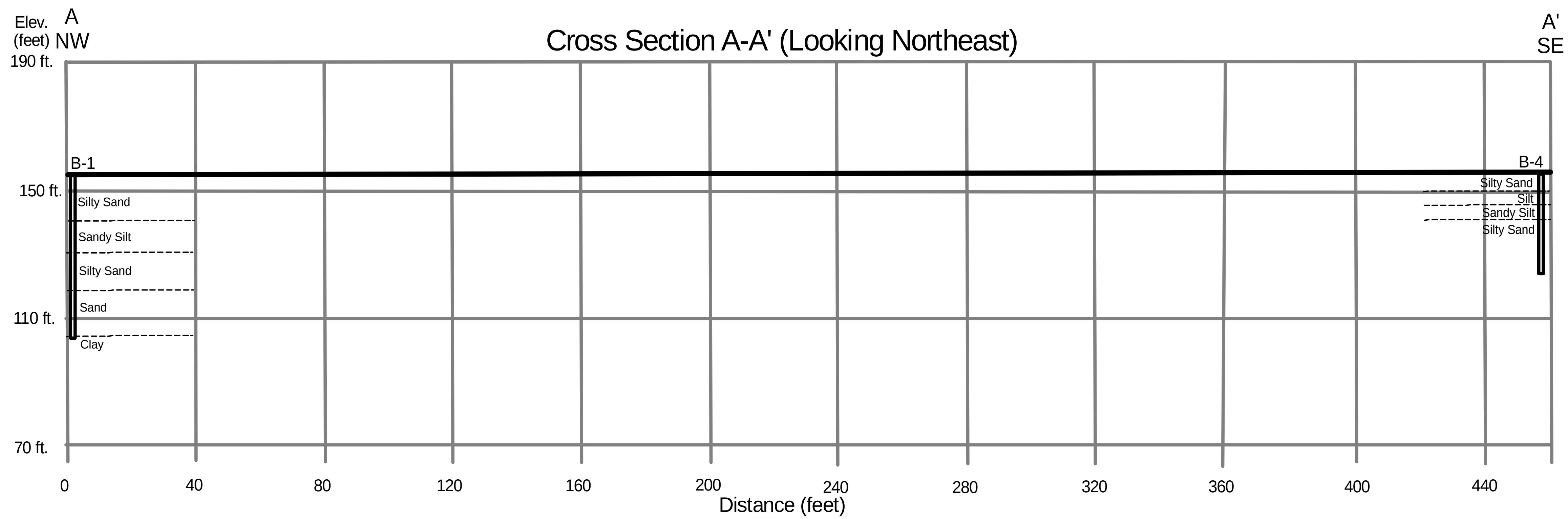
Geologic/Seismic Hazard Evaluation
Proposed New School Site APN 004-010-026
Atwater Elementary School District
Atwater, California

Figure C-4
Geologic Map
BSK Project G1926611F



0 40 80
Approximate Scale in Feet
Horizontal=Vertical

LEGEND

Unit Contact

Soil Boring Location

Groundwater Level (Year)

NOTES:
1) Locations are Approximate.

Geologic/Seismic Hazard Evaluation
Proposed New School Site APN 004-010-026
Atwater Elementary School District
Atwater, California

Figure C-5
Cross Section A-A'
BSK Project G1926611F

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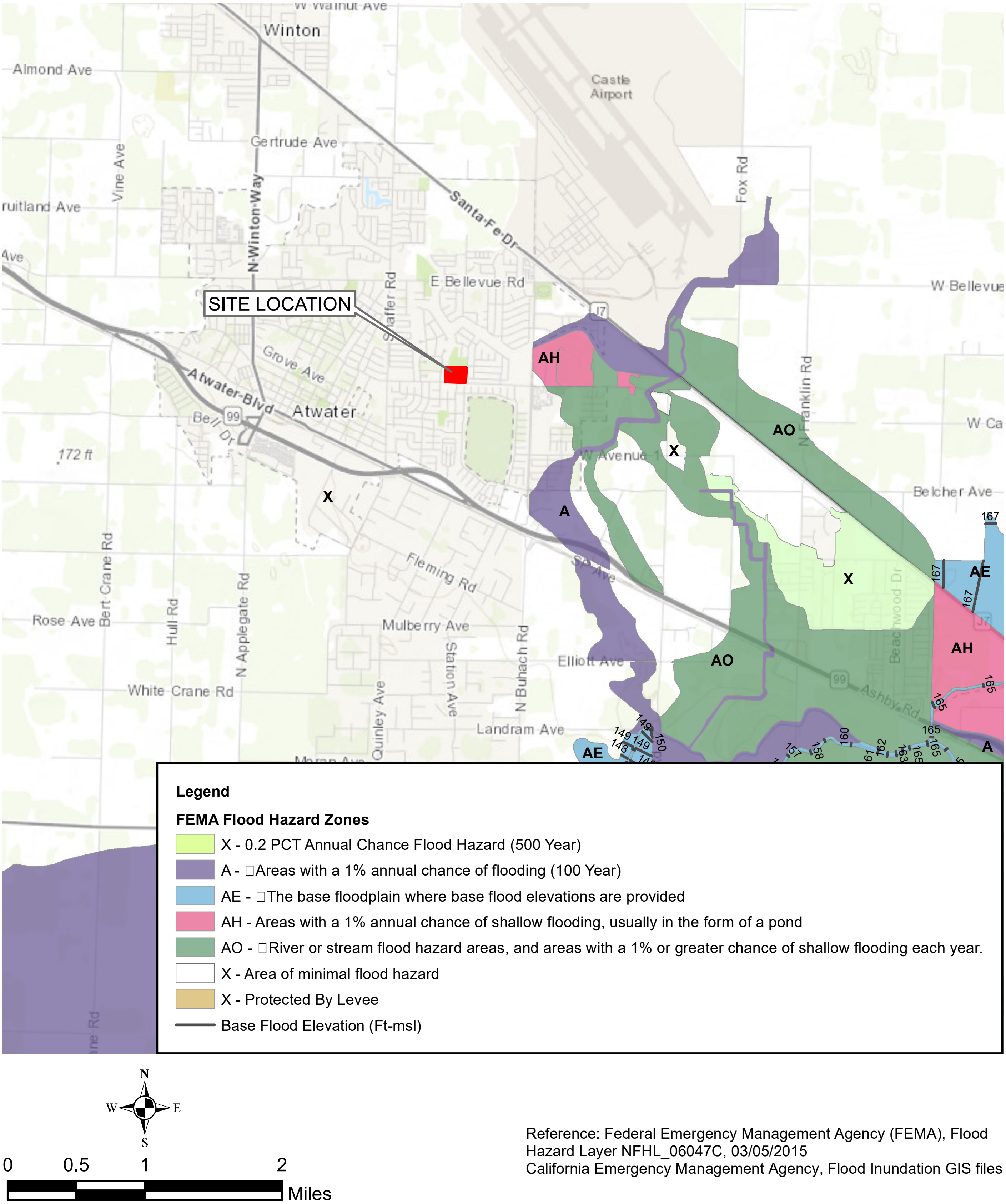

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Geologic/Seismic Hazard Evaluation
Proposed New School Site APN 004-010-026
Atwater Elementary School District
Atwater, California

Figure C-6
Flood Hazard Map
BSK Project G1926611F

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Reference: Federal Emergency Management Agency (FEMA), Flood Hazard Layer NFHL_06047C, 03/05/2015
California Emergency Management Agency, Flood Inundation GIS files

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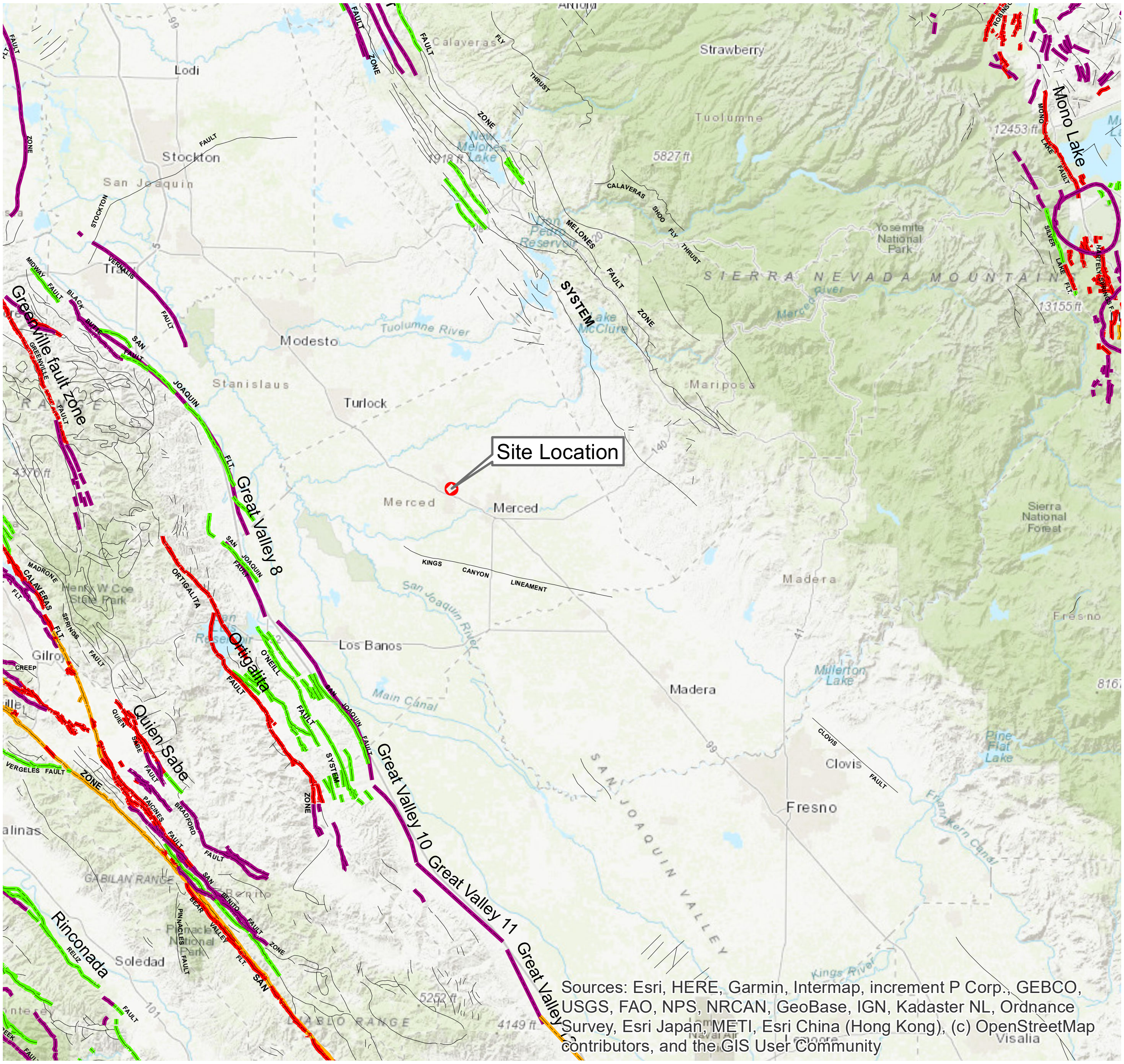
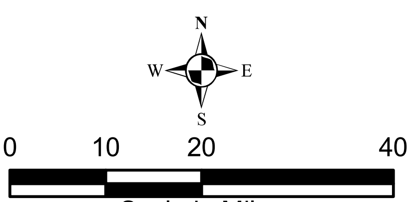
BSK ASSOCIATES	Geologic/Seismic Hazard Evaluation Proposed New School Site APN 004-010-026 Atwater Elementary School District Atwater, California	Figure C-7 Dam Inundation Map BSK Project G1926611F





Reference: Quaternary Faults=USGS Quaternary Fault Database
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Pre-Quarternary Faults= Fault Activity Map of California (2010) California Geological Survey
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Legend

Fault Activity Age

- Historic
- Latest Quaternary
- Late Quaternary
- Middle and Late Quaternary
- Undifferentiated Quaternary
- Pre-Quaternary Faults

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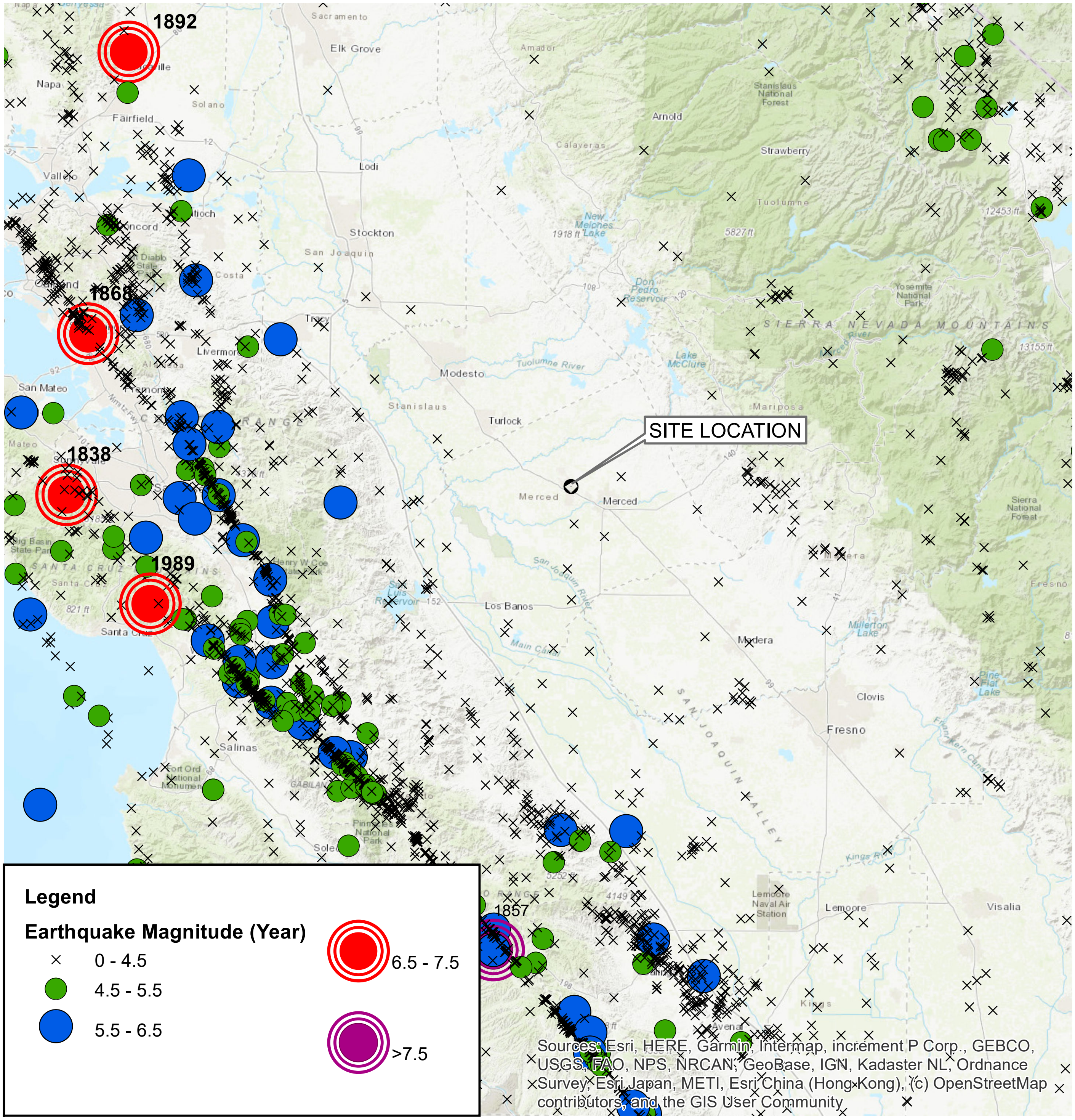
Geologic/Seismic Hazard Evaluation Proposed New School Site APN 004-010-026 Atwater Elementary School District Atwater, California	Figure C-8 Area Fault Map BSK Project G1926611F



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Miles

Source: National Seismic Hazard Model (NSHM) Earthquake Catalogs, 2014 NSHM Catalogs, USGS, https://github.com/usgs/nshmp-haz-catalogs

Map Date: 11/26/2019

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Geologic/Seismic Hazard Evaluation
Proposed New School Site APN 004-010-026
Atwater Elementary School District
Atwater, California

Figure C-9
Earthquake Epicenter Map
BSK Project G1926611F

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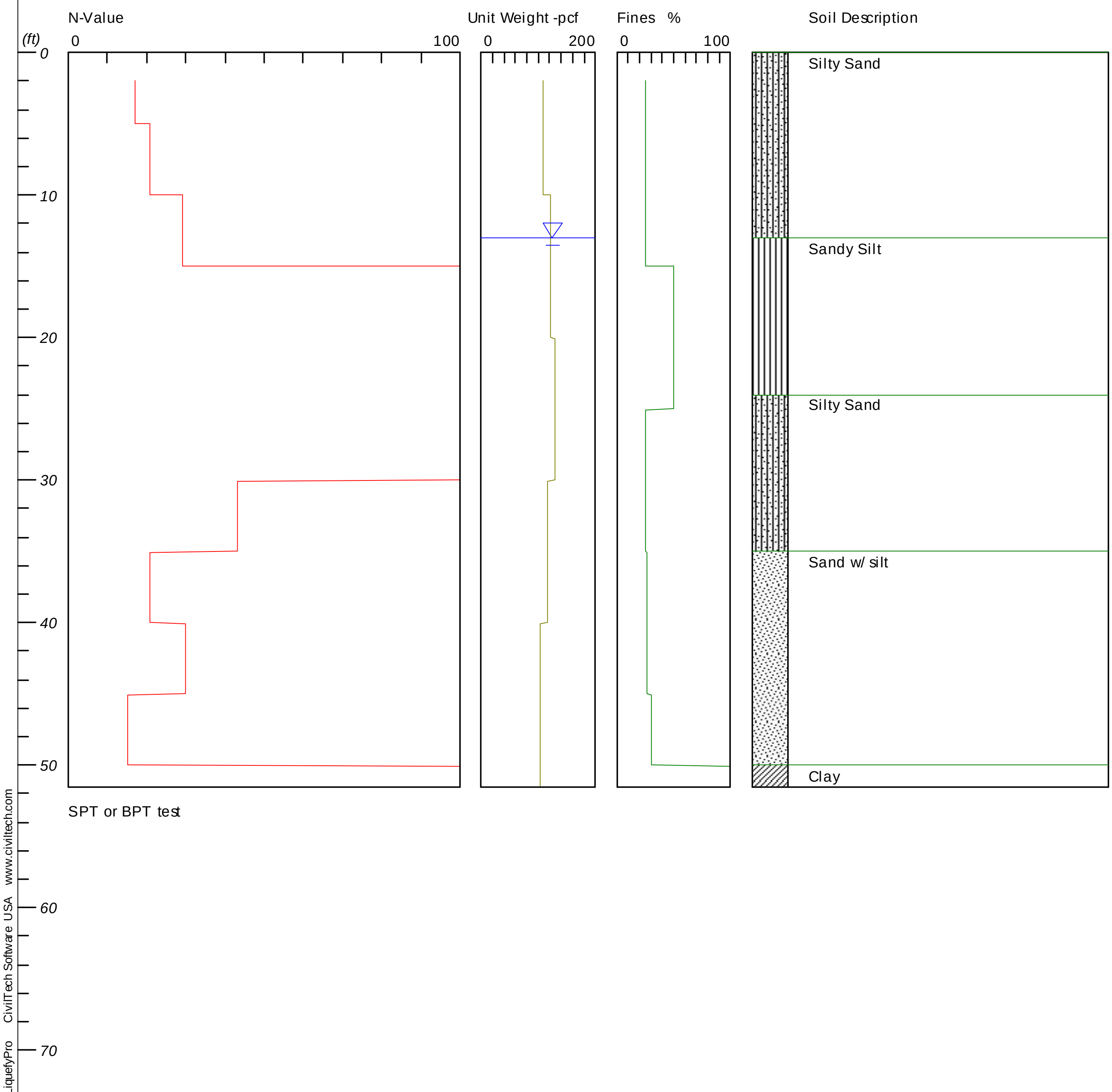
LIQUEFACTION ANALYSIS

Atwater Elementary School

Hole No.=B-1   Water Depth=13 ft

Magnitude=6.71
Acceleration=0.318g

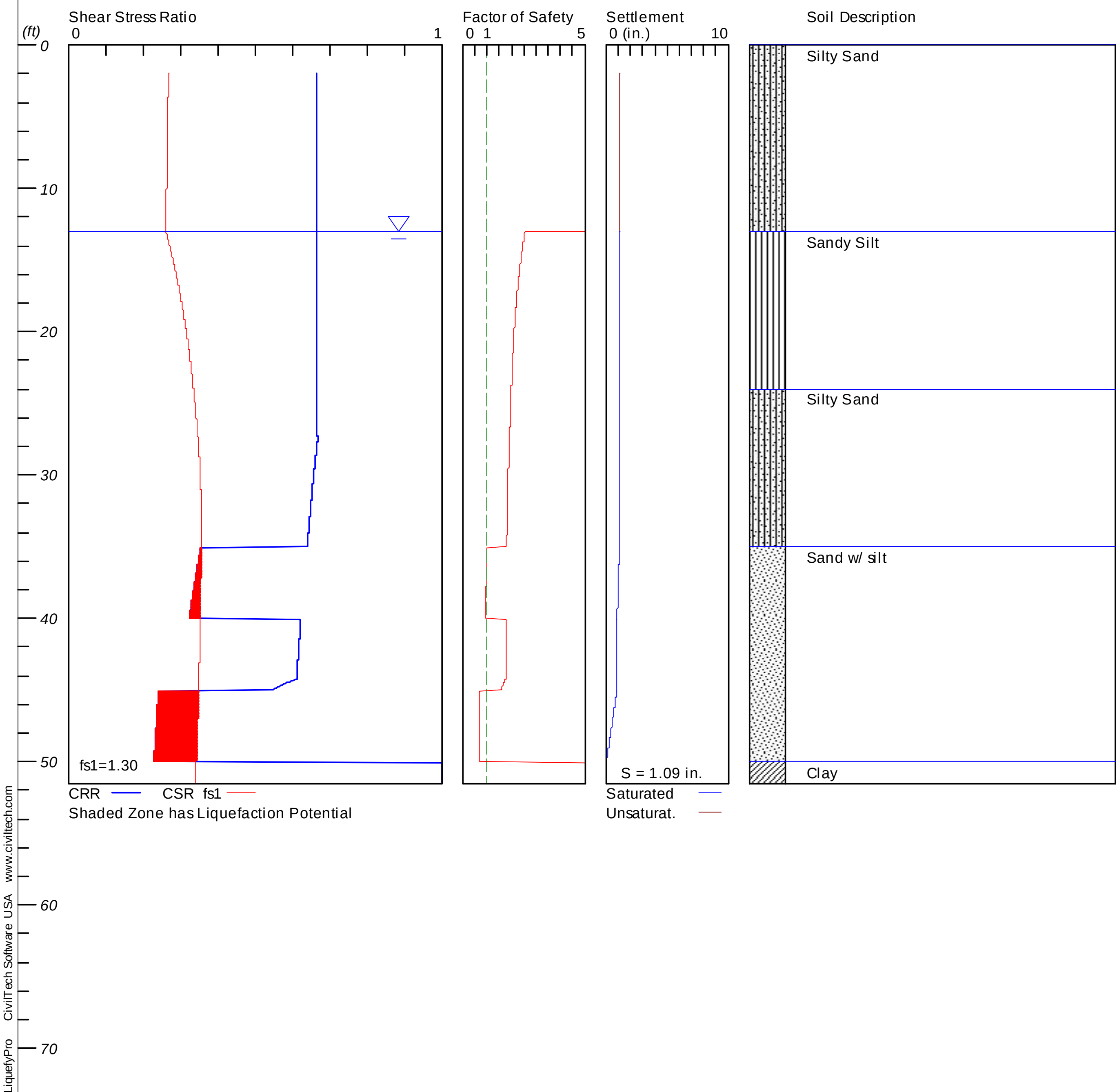


LIQUEFACTION ANALYSIS

Atwater Elementary School

Hole No.=B-1   Water Depth=13 ft

Magnitude=6.71
Acceleration=0.318g



BSK Associates

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LIQUEFACTION ANALYSIS SUMMARY

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Licensed to , 11/26/2019 12:53:47 PM

Input File Name: T:\Project Docs\G1926611F - New Atwater Elementary School\B-1.liq
Title: Atwater Elementary School
Subtitle:

Surface Elev.=
Hole No.=B-1
Depth of Hole= 51.50 ft
Water Table during Earthquake= 13.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration= 0.32 g
Earthquake Magnitude= 6.71

Input Data:

Surface Elev.=
Hole No.=B-1
Depth of Hole=51.50 ft
Water Table during Earthquake= 13.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration=0.32 g
Earthquake Magnitude=6.71
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
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 = 1.3
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
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	109.00	25.00
5.00	21.00	109.00	25.00
10.00	29.00	122.00	25.00
15.00	100.00	122.00	50.00
20.00	100.00	130.00	50.00
25.00	100.00	130.00	25.00
30.00	43.00	116.00	25.00
35.00	21.00	116.00	27.00
40.00	30.00	103.00	27.00
45.00	15.00	103.00	30.00
50.00	100.00	103.00	NoLiq

Output Results:

Settlement of Saturated Sands=1.07 in.
Settlement of Unsaturated Sands=0.02 in.
Total Settlement of Saturated and Unsaturated Sands=1.09 in.
Differential Settlement=0.543 to 0.717 in.

Appendix E

Airport Hazard Evaluation

DEPARTMENT OF TRANSPORTATION
DIVISION OF AERONAUTICS – M.S. #40
1120 N STREET
P. O. BOX 942874
SACRAMENTO, CA 94274-0001
PHONE (916) 654-4959
FAX (916) 653-9531
TTY 711
www.dot.ca.gov

Castle Airport
Merced County School File
Merced County

Making Conservation a California Way of Life.

May 20, 2020

Mr. John Gordon, Field Consultant
School Facilities Planning Division
California Department of Education
1430 N Street, Suite 1201
Sacramento, CA 95814-5901

Electronically Sent
jgordon@cde.ca.gov

Dear Mr. Gordon:

In response to your request of March 30, 2020, and Section 17215 of the California Education Code (EC), the California Department of Transportation (Caltrans), Division of Aeronautics, has analyzed the proposed K-8 school site located at the corner of East Juniper Avenue and Bridgewater Street in Atwater. The proposed school site is located approximately 10,800 feet southwest of Runway 31 of Castle Airport (MER).

Pursuant to EC section 17215, our analysis was conducted in accordance with the Title 21, California Code of Regulations (CCR) section 3570. Caltrans also considered the Merced County Airport Land Use Compatibility Plan (ALUCP), the California Airport Land Use Planning Handbook (Handbook), a Caltrans flight to determine where the proposed school site is located relative to aircraft flight paths and aircraft generated noise, our files, and other publications relating to aircraft operations at the airport. The Merced County Airport Land Use Commission and the airport's management were given an opportunity to comment, and their comments were considered.

The MER is an active general aviation airport with approximately 70 based aircraft and approximately 103,000 annual operations with one runway. Runway 13/31 is 11,802 feet long and is classified as a "Civilian Runway ≥ 6,000 feet long" according to the CCR. The CCR runway criteria were applied to the existing runway, and it was found that the proposed school site is located outside of all CCR Safety Zones.

In addition, the proposed school site location falls outside all the Safety Zones identified in both the Handbook and the Merced County ALUCP. The proposed school site must be in compliance with the Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*. FAA notification is required for any proposed structure or object located at this proposed site that exceeds an imaginary surface extending outward and upward at a slope of 100:1 from any point on the runway or is taller than 200 feet above ground level. To ensure compliance with FAR Part 77 notification requirements, submission of a Notice of Proposed Construction or Alteration (Form 7460-1) to the FAA may be required. Form 7460-1 is available on-line at https://oeaaa.faa.gov/oeaaa/external/portal.jsp and should be submitted electronically to the FAA. California Public Utilities Code (PUC), section 21659 also prohibits structural hazards near airports. This evaluation does not assume the heights of the proposed buildings located at this site are compliant with FAR Part 77 requirements. The sponsor must review the FAA Form 7460-1 process and complete, if required, to ensure the proposed buildings are not a hazard to air navigation.

On May 12, 2020, Caltrans conducted a flight inspection of the proposed school site. Our flight inspection revealed the proposed site is not likely to be directly over-flown by fixed-wing aircraft operating under visual flight rules and does not underlie the arrival, missed approach, or departure routes that are operating under instrument flight rules with currently used procedures. With respect to noise considerations the proposed school site is located outside the 65 decibel (dB) Community Noise Equivalent Level (CNEL) aircraft noise contour. Consequently, aircraft noise should not be an overriding issue at this location. However, children's schools are especially sensitive to noise and the Handbook encourages developers of schools to remain within 45dB CNEL for interior noise.

In summary, based upon our evaluation of existing conditions and planned development at the airport, Caltrans has no objection to the proposed site for an elementary school. While there is generally a low risk of an accident occurring at the proposed site, the potential consequences of any accident could be severe. Caltrans cannot guarantee the safety of this or any other site. If this proposed site is approved, the proposed site must be acquired by May 19, 2025, or another site evaluation by Caltrans is required prior to acquisition of the proposed school site.

This Caltrans recommendation is furnished pursuant to EC section 17215. This recommendation does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any federal, State, or local government body, nor does it constitute Caltrans approval relative to the PUC, the CCR, and other State statutory or regulatory code.

The PUC sections 21670 through 21679.5 establish a mandated process to implement airport land use laws throughout the State. Pertinent portions of PUC section 21670(a) state that it is "in the public interest to provide for the orderly development of each public use airport in this state and . . . to prevent the creation of new noise and safety problems." These sections require the creation of ALUCs within the counties, set forth the commissions' powers and duties, and call for the adoption of land use measures around the vicinity of public-use airports. Section 21670(f) specifically states that school districts are included among the local agencies that are subject to airport land use laws and other requirements of the PUC. School site acquisitions pursuant to EC section 17215 must comply with the above PUC sections.

If you have any questions or require further assistance, please contact me at (916) 654-5174 or via email at don.haug@dot.ca.gov.

Sincerely,

Original Signed by

DONALD E. HAUG
Aviation Safety Officer

Appendix F

Noise Impact Assessment

NOISE IMPACT ASSESSMENT

FOR

JUNIPER ELEMENTARY SCHOOL PROJECT

ATWATER ELEMENTARY SCHOOL DISTRICT

ATWATER, CA

APRIL 2020

PREPARED FOR:

ODELL PLANNING & RESEARCH, INC.
49370 ROAD 426, SUITE C
OAKHURST, CA 93644

PREPARED BY:

AMBIENT
AIR QUALITY & NOISE CONSULTING
612 12TH STREET, SUITE 201
PASO ROBLES, CA 93446

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INTRODUCTION

This report describes the existing noise environment in the project vicinity and identifies potential noise impacts associated with the development of the proposed Buckhorn Early Learning Center (Project). Project impacts are evaluated relative to the applicable noise level criteria adopted by the City of Salinas. Noise-reduction measures have been identified, where necessary, to reduce projected onsite noise levels at proposed noise-sensitive locations.

PROPOSED PROJECT OVERVIEW

The Atwater Elementary School District (District) is proposing to undertake the Juniper Elementary School Project (project). The proposed project includes the construction and operation of a new elementary school on a 10-acre site owned by the District. The site is located at the northwest corner of Juniper Avenue and Bridgewater Street in the city of Atwater, Merced County, CA. Figures 1 and 2 depict the Project Location and Project Site.

The elementary school would serve up to 600 students in grades TK-6. The campus would have 27 classrooms, administrative offices, a multi-purpose building, hardcourt areas and athletic fields which may include lighting. The school would be staffed by up to 45 employees, including administrators, faculty, and support staff. The school would be in regular session on weekdays from late August to early June, but may host special events and classes during evenings, on weekends, and during summer recess. The District estimates that construction of the project would begin in late 2021, with operation of the proposed elementary school beginning in August 2023.

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound, as described in more detail below, is mechanical energy transmitted in the form of a wave because of a disturbance or vibration.

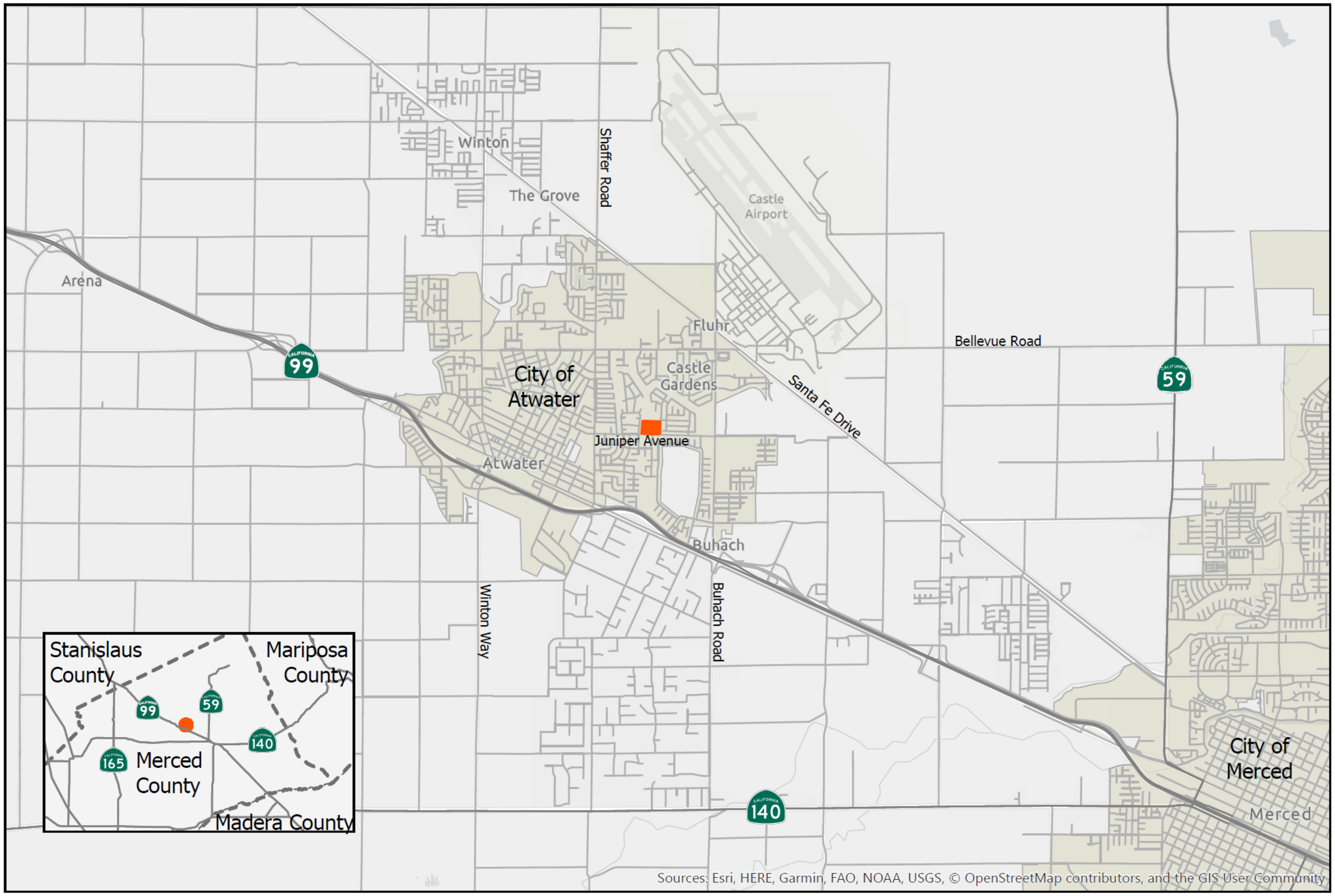
AMPLITUDE

Amplitude is the difference between ambient air pressure and the peak pressure of the sound wave. Amplitude is measured in decibels (dB) on a logarithmic scale. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Amplitude is interpreted by the ear as corresponding to different degrees of loudness. Laboratory measurements correlate a 10 dB increase in amplitude with a perceived doubling of loudness and establish a 3 dB change in amplitude as the minimum audible difference perceptible to the average person.

FREQUENCY

Frequency is the number of fluctuations in the pressure wave per second. The unit of frequency is the Hertz (Hz). One Hz equals one cycle per second. The human ear is not equally sensitive to the sound of different frequencies. Sound waves below 16 Hz or above 20,000 Hz cannot be heard at all, and the ear is more sensitive to sound in the higher portion of this range than in the lower. To approximate this sensitivity, environmental sound is usually measured in A-weighted decibels (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA. Common community noise sources and associated noise levels, in dBA, are depicted in Figure 3.

Figure 1. Project Location



Project Location **Figure 1**

Juniper Elementary School Project
Atwater Elementary School District

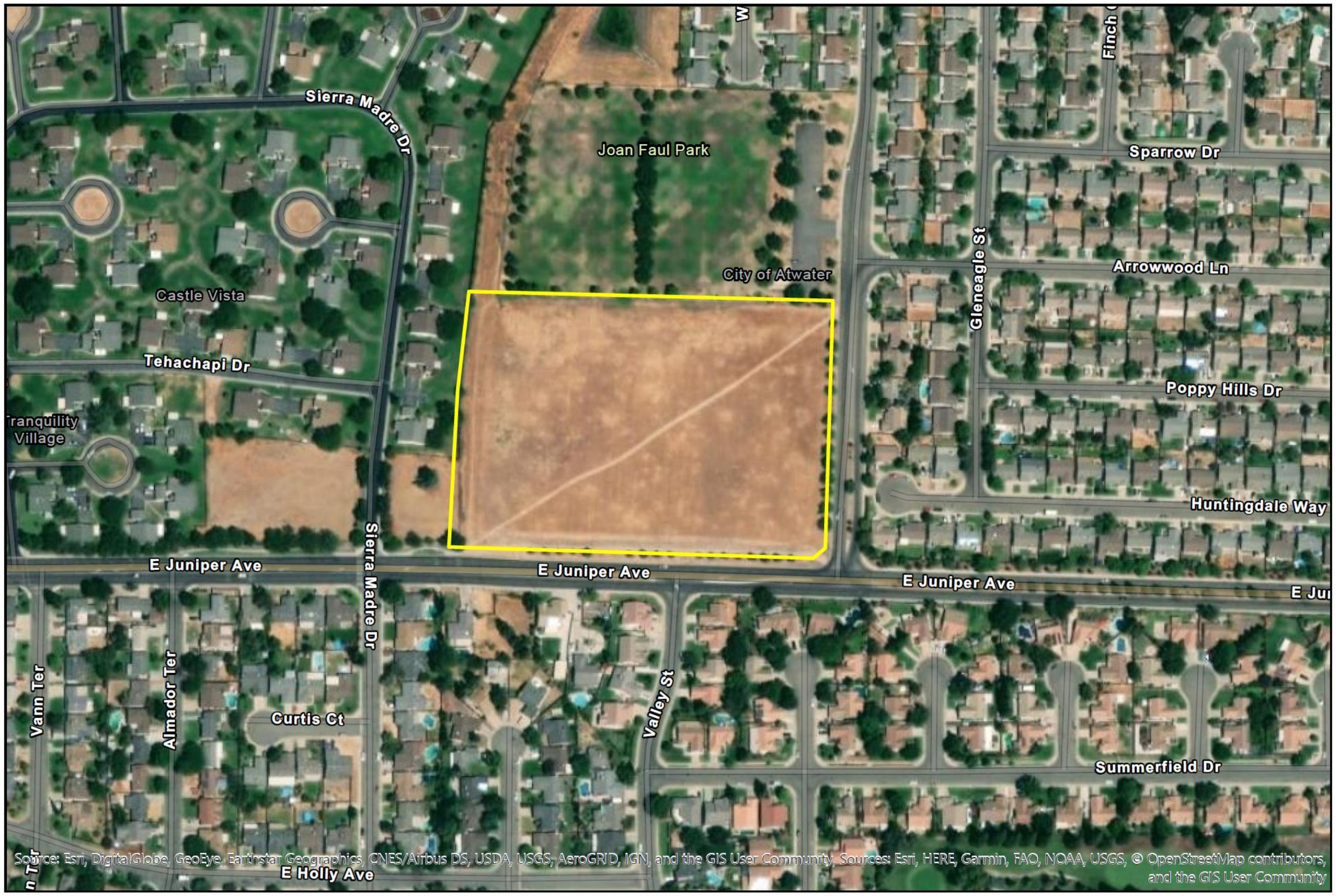
ODELL Planning & Research, Inc.
Environmental Planning • School Facility Planning • Demographics

Project Site
City Limits

0 0.5 1 2 Miles
N

Source: OPR 2020

Figure 2. Project Site



Project Site **Figure 2**

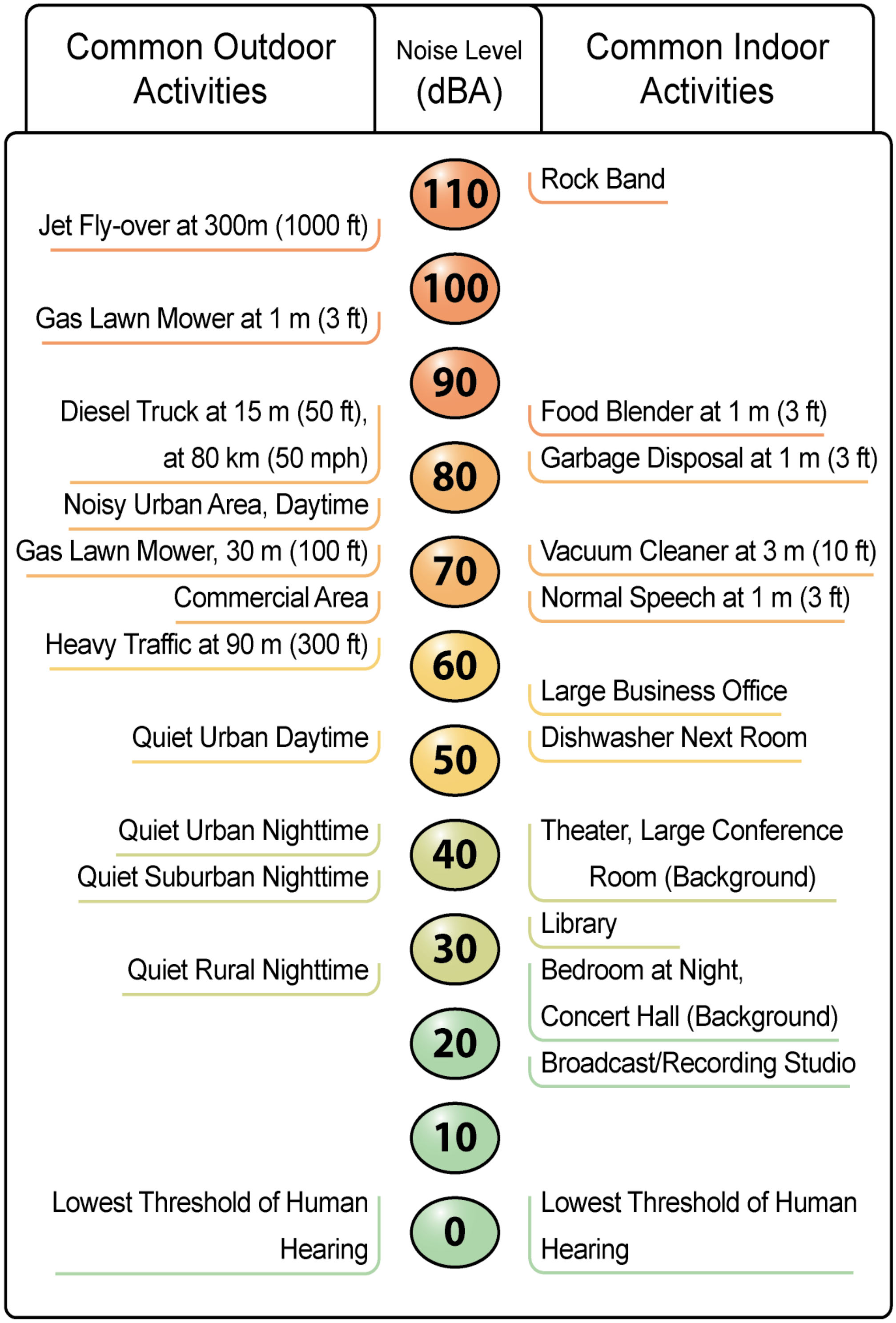
Juniper Elementary School Project
Atwater Elementary School District

ODELL Planning & Research, Inc.
Environmental Planning • School Facility Planning • Demographics

0 125 250 500 Feet
N

Source: OPR 2020

Figure 3. Typical Community Noise Levels



Source: Caltrans 2020

Addition of Decibels

Because decibels are logarithmic units, sound levels cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces a sound level of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together would produce an increase of 5 dB.

Sound Propagation & Attenuation

Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level decreases (attenuates) at a rate of approximately 6 decibels for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately 3 decibels for each doubling of distance from a line source, depending on ground surface characteristics. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water,), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between a line source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground-attenuation value of 1.5 decibels per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation for soft surfaces results in an overall attenuation rate of 4.5 decibels per doubling of distance from a line source.

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in an approximate 5 dB of noise reduction. Taller barriers provide increased noise reduction.

Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the sound-pressure level in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz, and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies, which is referred to as the "A-weighted" sound level (expressed in units of dBA). The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted noise scale. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with environmental noise.

The intensity of environmental noise fluctuates over time, and several descriptors of time-averaged noise levels are typically used. For the evaluation of environmental noise, the most commonly used descriptors are L_{eq}, L_{dn}, and CNEL. The energy-equivalent noise level, L_{eq}, is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average noise level, L_{dn}, is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to L_{dn} but adds an additional 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Common noise descriptors are summarized in Table 1.

Table 1. Common Acoustical Terms and Descriptors

Descriptor	Definition
Decibel (dB)	A unit-less measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to referenced sound pressure amplitude. The reference pressure is 20 micro-pascals.
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
Energy Equivalent Noise Level (L_{eq})	The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value (in dBA) is calculated.
Minimum Noise Level (L_{min})	The minimum instantaneous noise level during a specific period of time.
Maximum Noise Level (L_{max})	The maximum instantaneous noise level during a specific period of time.
Day-Night Average Noise Level (DNL or L_{dn})	The 24-hour Leq with a 10 dBA "penalty" for noise events that occur during the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours to account for increased sensitivity to noise during these hours.
Community Noise Equivalent Level (CNEL)	The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated L_{dn}.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well-being are the basis for land use planning policies preventing exposure to excessive community noise levels.

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged. Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived by humans;
- Outside of the laboratory, a 3-dB change is considered a just-perceivable difference;
- A change in level of at least 5 dB is required before any noticeable change in community response would be expected. An increase of 5 dB is typically considered substantial;
- A 10-dB change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

EFFECTS OF NOISE ON HUMAN ACTIVITIES

The extent to which environmental noise is deemed to result in increased levels of annoyance, activity interference, and sleep disruption varies greatly from individual to individual depending on various factors, including the loudness or suddenness of the noise, the information value of the noise (e.g., aircraft overflights, child crying, fire alarm), and an individual's sleep state and sleep habits. Over time, adaptation to noise events and increased levels of noise may also occur. In terms of land use compatibility, environmental noise is often evaluated in terms of the potential for noise events to result in increased levels of annoyance, sleep disruption, or interference with speech communication, activities, and learning. Noise-related effects on human activities are discussed in more detail, as follows:

Speech Communication

For most noise-sensitive land uses, an interior noise level of 45 dB L_{eq} is typically identified for the protection of speech communication in order to provide for 100-percent intelligibility of speech sounds. Assuming a minimum 20-dB reduction in sound level between outdoors and indoors, with windows closed, this interior noise level of 45 dB L_{eq} would equate to an exterior noise level of 65 dBA L_{eq}. For outdoor voice communication, an exterior noise level of 60 dBA L_{eq} allows normal conversation at distances up to 2 meters with 95 percent sentence intelligibility (U.S. EPA 1974.) Based on this information, speech interference begins to become a problem when steady noise levels reach approximately 60 to 65 dBA. Within interior noise environments, an average-hourly background noise level of 45 dBA L_{eq} is typically recommended for noise-sensitive land uses, such as educational facilities (Caltrans 2002[a].)

Learning

Closely related to speech interference are the effects of noise on learning and, more broadly, on cognitive tasks. Recent studies have shown a strong relationship between noise and children's reading ability. Children's attention spans also appear to be adversely affected by noise. Adults are affected as well. Some studies indicate that, in a noisy environment, adults have increased difficulty accomplishing complex tasks. One of the issues associated with the assessment of these effects is which noise metric correlates most closely with the impacts. For example, the average-daily noise level (i.e., CNEL/L_{dn}), which incorporates a nighttime weighting, may not be the best measure of noise impacts on schools given that operational activities are often limited to the daytime hours (Caltrans 2002(a.)

Various standards and recommended criteria have been developed to specifically address classroom noise. For instance, with regard to transportation sources, the California Department of Transportation has adopted abatement criteria that limit the maximum interior average-hourly noise level within classrooms, as well as other noise-sensitive interior uses, to 52 dBA L_{eq} (Caltrans 2006.) In June 2002, the American National Standards Institute, Inc. (ANSI) released a new classroom acoustics standard entitled Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools" (ANSI S12.60-2002). For schools exposed to intermittent background noise sources, such as airport and other transportation noise, the ANSI standards recommend that interior noise levels not exceed 40 dBA L_{eq} during the noisiest hour of the day. At present complying with the ANSI-recommended standard is voluntary in most locations.

Annoyance & Sleep Disruption

With regard to potential increases in annoyance, activity interference, and sleep disruption, land use compatibility determinations are typically based on the use of the cumulative noise exposure metrics (i.e., CNEL or L_{dn}). Perhaps the most comprehensive and widely accepted evaluation of the relationship between noise exposure and the extent of annoyance was one originally developed by Theodore J. Schultz in 1978. In 1978 the research findings of Theodore J. Schultz provided support for L_{dn} as the descriptor for environmental noise. Research conducted by Schultz identified a correlation between the cumulative noise exposure metric and individuals who were highly annoyed by transportation noise. The Schultz curve, expressing this correlation, became a basis for noise standards. When expressed graphically, this relationship is typically referred to as the Schultz curve. The Schultz curve indicates that approximately 13 percent of the population is highly annoyed at a noise level of 65 dBA L_{dn}. It also indicates that the percent of people describing themselves as being highly annoyed accelerates smoothly between 55 and 70 dBA L_{dn}. A noise level of 65 dBA L_{dn} is a commonly referenced dividing point between lower and higher rates of people describing themselves as being highly annoyed (Caltrans 2002[a].)

The Schultz curve and associated research became the basis for many of the noise criteria subsequently established for federal, state, and local entities. Most federal and state of California regulations and policies related to transportation noise sources establish a noise level of 65 dBA CNEL/L_{dn} as the basic limit of acceptable noise exposure for residential and other noise-sensitive land uses. For instance, with respect to aircraft noise, both the Federal Aviation Administration (FAA) and the State of California have identified a noise level of 65 dBA L_{dn} as the dividing point between normally compatible and normally incompatible residential land use generally applied for the determination of land use compatibility. For noise-sensitive land uses exposed to aircraft noise, noise levels in excess of 65 dBA CNEL/L_{dn} are typically considered to result in a potentially significant increase in levels of annoyance (Caltrans 2002[a].)

Allowing for an average exterior-to-interior noise reduction of 20 dB, an exterior noise level of 65 dBA CNEL/L_{dn} would equate to an interior noise level of 45 dBA CNEL/L_{dn}. An interior noise level of 45 dB CNEL/L_{dn} is generally considered sufficient to protect against activity interference at most noise-sensitive land uses, including residential dwellings, and would also be sufficient to protect against sleep interference (U.S. EPA 1974.) Within California, the California Building Code establishes a noise level of 45 dBA CNEL as the maximum acceptable interior noise level for residential uses (other than detached single-family dwellings). Use of the 45 dBA CNEL threshold is further supported by recommendations provided in the State of California Office of Planning and Research's *General Plan Guidelines*, which recommend an interior noise level of 45 dB CNEL/L_{dn} as the maximum allowable interior noise level sufficient to permit "normal residential activity."

The cumulative noise exposure metric is currently the only noise metric for which there is a substantial body of research data and regulatory guidance defining the relationship between noise exposure, people's reactions, and land use compatibility. However, when evaluating environmental noise impacts involving intermittent noise events, such as aircraft overflights and train passbys, the use of cumulative noise metrics may not provide a thorough understanding of the resultant impact. The general public often finds it difficult to understand the relationship between intermittent noise events and cumulative noise exposure metrics. In such instances, supplemental use of other noise metrics, such as the L_{eq} or L_{max} descriptor, may be helpful as a means of increasing public understanding regarding the relationship between these metrics and the extent of the resultant noise impact (Caltrans 2002[a].)

EXISTING NOISE ENVIRONMENT

NOISE-SENSITIVE LAND USES

Noise-sensitive land uses generally include those uses where exposure to noise would result in adverse effects, as well as uses where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Other noise-sensitive land uses include hospitals, convalescent facilities, parks, hotels, libraries, places of worship, and other uses where low interior noise levels are essential.

Nearby noise-sensitive land uses consist predominantly of residential dwellings. The nearest residential dwellings are located adjacent to and west of the project site, along Sierra Madre Drive. Residential uses are also located to the east of the project site, across Bridgewater Street, and to the south of the project site, across Juniper Avenue. In addition, Joan Faul Park is located adjacent to and north of the project site. Nearby land uses are depicted in Figure 2.

AMBIENT NOISE ENVIRONMENT

To document existing ambient noise levels in the project area, short-term ambient noise measurements were conducted on February 19, 2020, using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter. The meter was calibrated before use and is certified to be in compliance with ANSI specifications. Measured daytime ambient noise levels are summarized in Table 2. As indicated, measured daytime ambient average-hourly noise levels (in dBA L_{eq}) ranged from the low to mid 60's. Ambient noise levels are primarily influenced by vehicle traffic on area roadways.

Table 2. Summary of Measured Ambient Noise Levels

Location	Noise Sources Noted	Noise Level (dBA)	
		L_{eq}	L_{max}
Bridgewater Street, At roadway edge, approximately feet north of Juniper Avenue	Vehicle traffic on area roadways.	61.1	75.7
Juniper Avenue. At roadway edge, approximately feet west of Bridgewater Street	Vehicle traffic on area roadways.	65.9	72.9
Ambient noise measurements were conducted on February 19, 2020 using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter.			

REGULATORY SETTING

NOISE

<u>*State*</u>

The State of California regulates vehicular and freeway noise affecting classrooms, sets standards for sound transmission and occupational noise control, and identifies noise insulation standards and airport noise/land use compatibility criteria.

California General Plan Guidelines

The *State of California General Plan Guidelines*, published by the Governor's Office of Planning and Research (OPR 2017), also provides guidance for the acceptability of projects within specific CNEL/L_{dn} contours. The guidelines also present adjustment factors that may be used in order to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution. For school land uses, the *State of California General Plan Guidelines* identifies a "normally acceptable" exterior noise level of up to 70 dBA CNEL/L_{dn}. Schools are considered "conditionally acceptable" within noise environments of 60 to 70 dBA CNEL/L_{dn} and "normally unacceptable" within exterior noise environments of 70 to 80 CNEL/L_{dn} and "clearly unacceptable" within exterior noise environments in excess of 80 dBA CNEL/L_{dn}. Assuming a minimum exterior-to-interior noise reduction of 20 dB, an exterior noise environment of 65 dBA CNEL/L_{dn} would allow for a normally acceptable interior noise level of 45 dBA CNEL/L_{dn}.

Local

City of Atwater General Plan

To ensure that noise producers do not adversely affect sensitive receptors, the City uses land use compatibility standards when planning and making development decisions. The City's noise standards are based on land use designation and incorporation of available noise-reduction measures for determination of land use compatibility. Accordingly, educational land uses affected by transportation noise sources are considered "normally acceptable" within exterior noise environments up to 60 dBA CNEL/L_{dn}, and "conditionally acceptable" within exterior noise environments up to 75 dBA CNEL/L_{dn}. Educational land uses are considered "normally unacceptable" within exterior noise environments that exceed 75 dBA CNEL/L_{dn}. For schools, interior noise levels attributable to transportation noise sources should not exceed an average-hourly noise level of 45 dBA L_{eq}. These noise standards apply to newly proposed land uses for which the City has discretionary approval (City of Atwater 2000).

For new projects affected by non-transportation noise sources, the City has established maximum acceptable average-hourly exterior noise levels of 55 dBA L_{eq} for daytime hours (7:00 a.m. to 10:00 p.m.) and 45 dBA L_{eq} for nighttime hours (10:00 p.m. to 7:00 a.m.) Maximum instantaneous noise levels for these same daytime and nighttime hours of the day are limited to 75 dBA L_{max} and 65 dBA L_{max}, respectively (City of Atwater 2000).

City of Atwater Municipal Code

Chapter 8.44, Noise Control, of the City's Municipal Code identifies noise restrictions for existing non-transportation noise sources. Accordingly, construction activities are typically limited to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, and between 9:00 a.m. and 5:00 p.m. on Saturdays and Sundays. The City does not identify noise exposure standards for construction activities or other non-transportation noise sources. Activities conducted on public or private school grounds, including but not limited to athletic and school entertainment events, are exempt from the City's noise ordinance (City of Atwater 2007).

GROUNDBORNE VIBRATION

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of amplitude and frequency. A person's perception of the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating. Vibration can be measured in terms of acceleration, velocity, or displacement. Measurements in terms of velocity are expressed as peak particle velocity (PPV) with units of inches per second (in/sec).

There are no federal, state, or local regulatory standards for groundborne vibration. However, Caltrans has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans-recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance, are summarized in Table 3. The criteria apply to continuous vibration sources, which include vehicle traffic and most construction activities. All damage criteria for buildings are in terms of ground motion at the buildings' foundations. No allowance is included for the amplifying effects of structural components (Caltrans 2013).

As indicated in Table 3, the threshold at which there is a risk to normal structures from continuous events is 0.3 in/sec PPV for older residential structures and 0.5 in/sec PPV for newer building construction. With regard to human perception, vibration levels would begin to become distinctly perceptible at levels of 0.04 in/sec PPV for continuous events. Continuous vibration levels are considered potentially annoying for people in buildings at levels of 0.2 in/sec PPV.

Table 3. Summary of Groundborne Vibration Levels and Potential Effects

Vibration Level (in/sec ppv)	Human Reaction	Effect on Buildings
0.006 - 0.019	Threshold of perception; possibility of intrusion.	Vibrations unlikely to cause damage of any type.
0.08	Vibrations readily perceptible.	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected.
0.10	Level at which continuous vibrations are strongly perceptible and begin to annoy people.	Virtually no risk of "architectural" damage to normal buildings.
0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relatively short periods of vibrations).	Threshold at which there is a risk of "architectural" damage to fragile buildings.
0.3 - 0.7	Continuous vibrations generally considered severe at 0.4 in/sec ppv at disturbing to people in open environments at 0.7 in/sec ppv.	Potential risk of "architectural" damage may occur at levels above 0.3 in/sec ppv for older residential structures and above 0.5 in/sec ppv for newer structures.

The vibration levels are based on peak particle velocity in the vertical direction for continuous/frequent intermittent vibration sources, which includes most construction activities.
Source: Caltrans 2013

IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

The following significance thresholds used for the assessment of noise-related impacts are based on the California Environmental Quality Act (CEQA) Guidelines and City of Salinas' noise standards.

- **Short-term Noise Exposure Impacts**. Short-term construction noise impacts would be considered significant if construction activities would result in substantial increases in ambient noise levels during the more noise-sensitive nighttime hours (i.e., 7:00 p.m. to 7:00 a.m.), in accordance with the City's noise control ordinance.
- **Long-term Noise Exposure Impacts**. Long-term non-transportation and transportation noise impacts would be considered significant if the proposed project would result in substantial increases in ambient noise levels at nearby noise-sensitive land uses that would exceed the City's exterior noise exposure standards (e.g., 55 dBA L_{eq} during the daytime hours).
- **Groundborne Vibration**. The CEQA Guidelines do not define the levels at which groundborne vibration levels would be considered excessive. For this reason, Caltrans' recommended groundborne vibration thresholds were used for the evaluation of impacts based on the increased potential for structural damage and human annoyance, as identified in Table 3. Based on these levels, groundborne vibration levels exceeding 0.5 in/sec ppv at nearby structures would be considered to have a potentially significant impact with regard to structural damage. Groundborne vibration levels exceeding 0.2 in/sec ppv at nearby structures would be considered to have a potentially significant impact with regard to human annoyance (Caltrans 2013).
- **Substantial Increase in Noise Levels**. The *CEQA Guidelines* do not define the levels at which temporary and permanent increases in ambient noise are considered "substantial." As discussed previously in this section, a noise level increase of 3 dBA is barely perceptible to most people, a 5 dBA increase is readily noticeable, and a difference of 10 dBA would be perceived as a doubling of loudness. For purposes of

this analysis, a significant increase in ambient noise levels would be defined as an increase of 3 dBA, or greater.

METHODOLOGY

Short-Term Construction Noise

Short-term noise impacts associated with construction activities were analyzed based on typical construction equipment noise levels and distances to the nearest noise-sensitive land uses. Noise levels were predicted based on an average noise-attenuation rate of 6 dB per doubling of distance from the source.

Long-term Operational Noise

Non-transportation noise levels were evaluated based on representative noise levels derived from existing environmental documentation and noise monitoring data obtained from similar land uses. Traffic noise levels were calculated using the Federal Highway Administration (FHWA) roadway noise prediction model (FHWA-RD-77-108) based on California's vehicle reference noise levels and traffic data obtained from the traffic analysis prepared for this project. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. The project's contribution to traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic.

IMPACT DISCUSSIONS AND MITIGATION MEASURES

Impact Noise-A:	***Would the project result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?***

Noise generated by the proposed project would occur during short-term construction and long-term operation. Noise-related impacts associated with short-term construction and long-term operations of the proposed project are discussed separately, as follows:

Short-term Construction Noise

Construction noise typically occurs intermittently and varies depending upon the nature or phase (e.g., demolition/land clearing, grading and excavation, erection) of construction. Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. Although noise ranges were found to be similar for all construction phases, the initial site preparation phase tended to involve the most equipment.

As noted in Table 4, instantaneous noise levels (in dBA L_{max}) generated by individual pieces of construction equipment typically range from approximately 80 dBA to 85 dBA L_{max} at 50 feet (FTA 2018). Typical operating cycles may involve 2 minutes of full power, followed by 3 or 4 minutes at lower settings. Based on typical off-road equipment usage rates, average-hourly noise levels would be approximately 82 dBA L_{eq}, or less, at 50 feet.

The City has not adopted noise standards that apply to short-term construction activities. However, based on screening noise criteria commonly recommended by federal agencies, construction activities would generally be considered to have a potentially significant impact if average-hourly daytime noise levels would exceed 80 dBA L_{eq} at noise-sensitive land uses, such as residential land uses (FTA 2018). Assuming an average-hourly construction noise level of 82 dBA L_{eq} at 50 feet, the highest predicted noise levels at the nearest residences would be approximately 76 dBA L_{eq}. Predicted exterior noise levels would not exceed the exterior noise threshold of 80 dBA L_{eq}. However, with regard to residential land uses, activities occurring during the more noise-sensitive evening and nighttime hours could result in increased levels of annoyance and potential sleep disruption. Because the proposed project does not identify hourly restrictions for noise-generating construction activities, noise-generating construction activities would be considered to have a ***potentially significant*** short-term noise impact.

Table 4. Typical Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 feet from Source	
	L_{max}	L_{eq}
Air Compressor	80	76
Backhoe/Front-End Loader	80	76
Compactor	80	73
Concrete Mixer Truck	85	81
Concrete Vibratory Mixer	80	73
Crane, Mobile	85	77
Dozer	85	81
Excavator	85	81
Generator	82	79
Grader	85	81
Jack Hammer	85	78
Paver	85	82
Pneumatic Tools	85	82
Roller	85	78
Sources: FTA 2018		

Mitigation Measures

MM Noise-1: The following measures shall be implemented:

a. Construction activities (excluding activities that would result in a safety concern to the public or construction workers) shall be limited to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, and between 9:00 a.m. and 5:00 p.m. on Saturdays and Sundays..

b. Stationary construction equipment (e.g., portable power generators) should be located at the furthest distance possible from nearby residences. If deemed necessary, portable noise barriers shall be erected sufficient to shield nearby residences from direct line-of-sight of stationary construction equipment.

c. Construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment-engine shrouds shall be closed during equipment operation.

d. When not in use, motorized construction equipment shall not be left idling for periods greater than five minutes.

Significance After Mitigation

Implementation of the above mitigation measures would limit construction activities to the less noise-sensitive daytime hours, which would reduce potential increases in levels of annoyance and sleep disruption to occupants of nearby residential dwellings. Additional measures, such as limitations on equipment idling and use of equipment exhaust mufflers, would further reduce potential noise impacts to nearby land uses. With mitigation and given that construction-related activities would be short-term, this impact is considered ***less than significant***.

Long-term Operational Noise

Potential long-term increases in noise associated with the proposed project would be primarily associated with the operation of building equipment, such as heating, ventilation, and air conditioning (HVAC) units, outdoor recreational activities, and vehicle use within onsite parking lots.

Stationary Equipment

The proposed project would not result in the introduction of any new major sources of stationary noise sources. Stationary noise sources would be predominantly associated with the operation of building mechanical equipment. Building mechanical equipment would be located within the structure, enclosed, or placed on rooftop areas away from direct public exposure. In addition, the operation of building mechanical equipment would be predominantly limited to the daytime hours of operations. As a result, significant increases in noise levels associated with onsite building mechanical equipment would not be projected to occur with project implementation. Noise levels associated with stationary equipment operation would be considered to have a ***less-than-significant*** impact.

Recreational Facilities

Playgrounds

The proposed project would include construction of onsite playground areas. No major outdoor recreational facilities that would generate high noise levels, such as ball fields or stadiums that would involve the use of amplified public address systems or involve large spectator crowds, are proposed. Noise generated by playgrounds typically includes elevated children's voices and occasional adult voices. Based on measurement data obtained from existing elementary schools and similar land uses, noise levels associated with small playgrounds can generate intermittent noise levels of approximately 55-60 dBA L_{eq} at 50 feet. Noise associated with the use of onsite playgrounds would be intermittent and limited predominantly to the daytime hours of operation. As a result, the use of onsite playgrounds would not result in a significant increase in average-daily noise levels at nearby residential land uses. In addition, noise generated by playgrounds are typically not considered uncharacteristic of or incompatible with residential land uses. Noise generated by proposed onsite playground areas would be considered to have a **less-than-*significant*** impact.

Vehicle Parking Areas

No large parking facilities or garages are proposed. However, the proposed project would include construction of smaller onsite vehicle parking areas. The size or proposed onsite parking facilities have not yet been identified. However, parking facilities commonly associated with elementary schools typically average fewer than 100 parking spaces. Noise levels commonly associated with smaller vehicle parking areas (e.g., less than 100 parking spaces) typically average approximately 45 dBA L_{eq}, or less, within approximately 10 feet of the parking lot. Based on the traffic analysis prepared for this project, the proposed school would generate a maximum of approximately 402 vehicles during the a.m. peak hour. Based on this volume and a conservative assumption that all vehicles would utilize onsite parking areas, the highest predicted noise level at 10 feet from the parking lot would 50 dBA L_{eq}. Actual noise levels would likely be less given that not all vehicle would be anticipated to utilize onsite parking. Noise levels generated by onsite parking areas would not be predicted to exceed the City's exterior daytime noise standard of 55 dBA L_{eq}. In addition, as previously noted, average-hourly daytime noise levels at the project site boundaries generally range from the low to mid 60's in dBA L_{eq}. In comparison to ambient daytime noise levels, proposed onsite parking areas would not be anticipated to result in a substantial increase in ambient noise levels at nearby receptors. For these reasons, noise generated by the proposed onsite parking areas would be considered to have a ***less-than-significant*** impact.

Long-term Increases in Traffic Noise

Ambient noise levels in the project area are predominantly influenced by vehicular traffic on area roadways. The FHWA roadway noise prediction model was used to predict traffic noise levels along primarily affected roadway segments. Predicted noise levels were calculated for baseline conditions, with and without implementation of the proposed project, based on traffic volumes obtained from the traffic analysis prepared for this project. Predicted increases in traffic noise levels are summarized in Table 5.

As noted in Table 5, implementation of the proposed project would result in increases of approximately 1.9 dBA L_{dn}/CNEL, or less, along area roadways. Implementation of the proposed project would not result in a noticeable increase (i.e., 3 dBA or greater) in ambient noise levels. Increases in traffic noise would be considered to have a ***less-than-significant*** impact.

Table 5. Predicted Changes in Traffic Noise Levels

Roadway Segment	Predicted Noise Level at 50 ft from Centerline of Near Travel Lane (dBA Ldn/CNEL)[1]			
	Without Project	With Project	Difference	Significant? [2]
Existing Conditions				
Sierra Madre Dr., South of Juniper Ave.	46.7	47.0	0.3	No
Bridgewater St., North of Juniper Ave	54.0	55.5	1.5	No
Juniper Ave., East of Sierra Madre Dr.	65.2	65.6	0.4	No
Juniper Ave., East of Bridgewater St.	64.3	64.7	0.4	No
Future Cumulative Conditions				
Sierra Madre Dr., South of Juniper Ave.	51.6	51.6	0	No
Bridgewater St., North of Juniper Ave	56.4	58.3	1.9	No
Juniper Ave., East of Sierra Madre Dr.	66.4	66.6	0.2	No
Juniper Ave., East of Bridgewater St.	66.1	66.3	0.2	No

1. *Traffic noise levels were predicted using the FHWA roadway noise prediction model based on traffic information obtained from the traffic analysis prepared for this project (JLB 2019). Modeled estimates assume no natural or man-made shielding (e.g., vegetation, berms, walls, buildings).*
2. *A significant increase is defined as a noticeable increase of 3 dBA, or greater, that would exceed applicable noise standards.*

Land Use Compatibility

In accordance with City of Atwater General Plan policies, school uses exposed to transportation noise sources are typically limited to 60 dB L_{dn} in outdoor activity areas and 45 dB L_{dn} in interior spaces. Based on the traffic noise modeling noted above, predicted future cumulative exterior traffic noise levels at the boundary of the project site would be approximately 66 dBA CNEL at 50 feet from the Juniper Avenue near-travel-lane centerline. Based on this predicted noise level, the projected on-site 60 dBA CNEL noise contour would extend to approximately 184 feet from the centerline of Juniper Avenue.

Based on this predicted noise level and assuming an average exterior-to-interior noise reduction of 25 dBA, which is typical for newer building construction, predicted onsite interior noise levels would be approximately 41 dBA CNEL, or less. Predicted interior noise levels would not exceed the City's interior noise standard of 45 dBA CNEL. However, because the final site design has not yet been determined, predicted noise levels at exterior activity areas could potentially exceed the City's noise standard of 60 dBA CNEL, if outdoor activity area are located within 184 feet of the centerline of Juniper Avenue. As a result, this impact would be considered ***potentially significant***.

Mitigation Measures

MM Noise-2: The project site shall be designed so that outdoor activity areas are located in excess of 184 feet from the centerline of Juniper Avenue.

Significance After Mitigation

With implementation of MM Noise-2, predicted onsite noise levels at outdoor activity areas would not exceed 60 dBA CNEL. With mitigation, this impact is considered ***less than significant***.

Impact Noise-B: ***Would the project result in the generation of excessive groundborne vibration or groundborne noise levels?***

Long-term operational activities associated with the proposed project would not involve the use of any equipment or processes that would result in potentially significant levels of ground vibration. Increases in groundborne vibration levels attributable to the proposed project would be primarily associated with short-term construction-related activities. Construction activities associated with the proposed project would likely require the use of various off-road equipment, such as tractors, concrete mixers, and haul trucks. The use of major groundborne vibration-generating construction equipment, such as pile drivers, would not be required for this project.

Groundborne vibration levels associated with representative construction equipment are summarized in Table 6. As depicted, ground vibration generated by construction equipment would be approximately 0.08 in/sec ppv, or less, at 25 feet. Predicted vibration levels at the nearest existing structures would not exceed the minimum recommended criteria for structural damage and human annoyance (0.5 and 0.2 in/sec ppv, respectively). As a result, this impact would be considered ***less than significant.***

Table 6. Representative Construction Equipment Vibration Levels

Equipment	Peak Particle Velocity at 25 Feet (In/Sec)
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozers/Tractors	0.003
Source: FTA 2018, Caltrans 2013	

Impact Noise-C: ***Would the project be located within the vicinity of a private airstrip or 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?***

The nearest airport is the Merced County Castle Airport located approximately 1.4 miles northeast of the project site. The project site is not located within the projected 60 dBA CNEL contour of this airport (City of Atwater 2000). No private airstrips are located within two miles of the project site. For these reasons, this impact is considered ***less than significant***.

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APPENDIX A

NOISE PREDICTION MODELING & SUPPORTIVE DOCUMENTATION

TRAFFIC NOISE PREDICTION

ROADWAY SEGMENT	SPEED	ADT	CNEL AT 50' FROM NTLCL	DISTANCE TO 60 CNEL CONTOUR
EXISTING				
SIERRA MADRE DR, SOUTH OF JUNIPER AVE	25	370	46.7	
BRIDGEWATER ST, NORTH OF JUNIPER AVE	25	2010	54	
JUNIPER AVE, EAST OF SIERRA MADRE DRIVE	40	11130	65.2	
JUNIPER AVE, EAST OF BRIDGEWATER ST	40	9160	64.3	
EXISTING PLUS PROJECT				
SIERRA MADRE DR, SOUTH OF JUNIPER AVE	25	400	47	
BRIDGEWATER ST, NORTH OF JUNIPER AVE	25	2820	55.5	
JUNIPER AVE, EAST OF SIERRA MADRE DRIVE	40	12150	65.6	
JUNIPER AVE, EAST OF BRIDGEWATER ST	40	9800	64.7	
CUMULATIVE				
SIERRA MADRE DR, SOUTH OF JUNIPER AVE	25	1140	51.6	
BRIDGEWATER ST, NORTH OF JUNIPER AVE	25	3500	56.4	
JUNIPER AVE, EAST OF SIERRA MADRE DRIVE	40	14620	66.4	
JUNIPER AVE, EAST OF BRIDGEWATER ST	40	13830	66.1	
CUMULATIVE PLUS PROJECT				
SIERRA MADRE DR, SOUTH OF JUNIPER AVE	25	1140	51.6	WRR
BRIDGEWATER ST, NORTH OF JUNIPER AVE	25	5360	58.3	WRR
JUNIPER AVE, EAST OF SIERRA MADRE DRIVE	40	15310	66.6	184
JUNIPER AVE, EAST OF BRIDGEWATER ST	40	14470	66.3	177

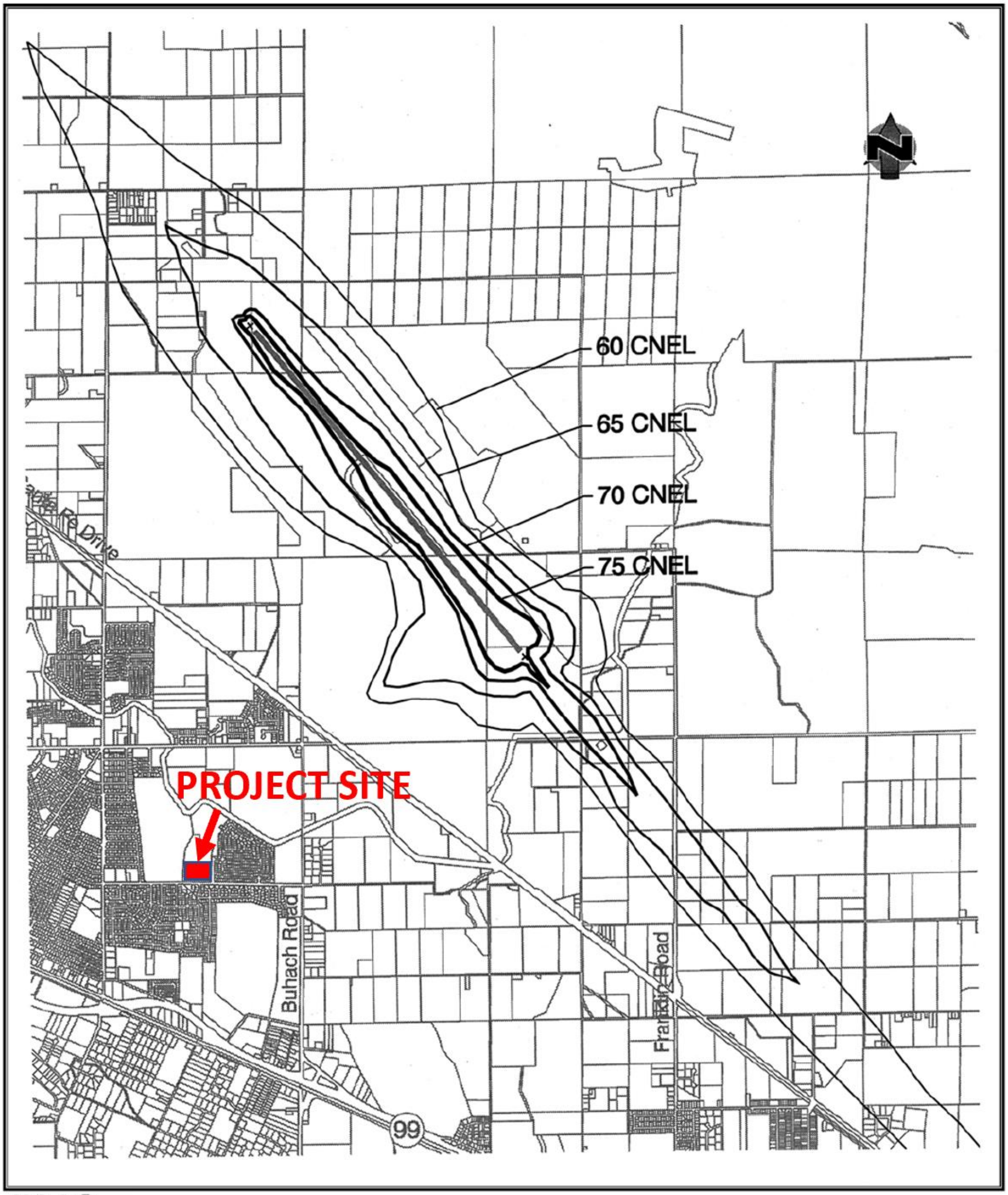
NOISE MONITORING SURVEY FORM

DATE: 02/19/2020

PROJECT SITE LOCATION

EQUIPMENT: LARSON DAVIS TYPE I MODEL 820
TEMP: 65 F HUM: 45% WIND SPEED; 1-2 MPH SKY: CLEAR GROUND: DRY

Monitoring Location	Primary Noise Sources Noted	Noise Level (dBA)	
		L_{eq}	L_{max}
Bridgewater Street, At roadway edge, approximately feet north of Juniper Avenue	Vehicle traffic on area roadways.	61.1	75.7
Juniper Avenue. At roadway edge, approximately feet west of Bridgewater Street	Vehicle traffic on area roadways.	65.9	72.9



PMC
PACIFIC MUNICIPAL CONSULTANTS

FIGURE 6-6
NOISE IMPACT AREA - CASTLE AIRPORT

Appendix G

Traffic Impact Analysis

Traffic Impact Analysis Report

Atwater Elementary School District Elementary School

Located on the Northwest Corner of Bridgewater Street and Juniper Avenue

In the City of Atwater, California

Prepared for

Odell Planning & Research, Inc.
49346 Road 426, Suite 2
Oakhurst, CA 93644

September 3, 2020

Project No. 005-005

JLB TRAFFIC ENGINEERING, INC.

Traffic Engineering, Transportation Planning, & Parking Solutions

516 W. Shaw Ave., Ste. 103
Fresno, CA 93710
Phone: (559) 570-8991
www.JLBtraffic.com

Traffic Engineering, Transportation Planning, & Parking Solutions

Traffic Impact Analysis Report

For the Atwater Elementary School District Elementary School located on the Northwest Quadrant of Bridgewater Street and Juniper Avenue

In the City of Atwater, CA

September 3, 2020

This Traffic Impact Analysis Report has been prepared under the direction of a licensed Traffic Engineer. The licensed Traffic Engineer attests to the technical information contained therein and has judged the qualifications of any technical specialists providing engineering data from which recommendations, conclusions, and decisions are based.

Prepared by:

Jose Luis Benavides, PE, TE
President

Traffic Engineering, Transportation Planning, & Parking Solutions
516 W. Shaw Ave., Ste. 103
Fresno, CA 93704
Phone: (559) 570-8991
www.JLBtraffic.com

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Introduction and Summary

Introduction

This Report describes a Traffic Impact Analysis (TIA) prepared by JLB Traffic Engineering, Inc. (JLB) for the Atwater Elementary School District (AESD) Elementary School (Project) located on the northwest corner of Bridgewater Street and Juniper Avenue in the City of Atwater. The Project proposes to build an elementary school estimated to serve up to 600 students. Based on data provided by AESD, the Project is within a defined service area that is currently being served by other schools – Bellevue Elementary (Bellevue), Shaffer School (Shaffer) and Thomas Olaeta Elementary (Thomas Olaeta). Based on information provided to the JLB, the Project is consistent with the City of Atwater 2020 General Plan. Figure 1 shows the location of the proposed Project site relative to the surrounding roadway network.

The purpose of this TIA is to evaluate the potential on-site and off-site traffic impacts, identify short-term roadway and circulation needs, determine potential mitigation measures, and identify any critical traffic issues that should be addressed in the on-going planning process. The scope of work was prepared via consultation with City of Atwater, County of Merced, and Caltrans staff.

Summary

The potential traffic impacts of the proposed Project were evaluated in accordance with the standards set forth by the level of service (LOS) policy of the City of Atwater, County of Merced, and Caltrans.

Existing Traffic Conditions

- At present, all study intersections operate at an acceptable LOS during both peak periods.

Existing plus Project Traffic Conditions

- The latest Project Site Plan addresses recommendations for the Project exit-only driveway along Juniper Avenue and the northwest corner of Bridgewater and Juniper Avenue.
- A review of the access points to be constructed indicates that they are located at points that minimize traffic operational impacts to the existing roadway network.
- At build-out, the Project is estimated to generate a maximum of 1,134 daily trips, 402 AM peak hour trips and 204 PM peak hour trips.
- The latest Project Site Plan retains the existing Class I Bike Path along its frontage to Juniper Avenue.
- It is recommended that the Project retain existing ADA compliant walkways along its frontages to Bridgewater Street and Juniper Avenue.
- The latest Project Site Plan includes on-site pedestrian features and high-visibility crosswalks across the north leg and west leg of the intersection of Bridgewater Street and Juniper Avenue.
- It is recommended that a) a high-visibility crosswalk with a rapid rectangular flashing beacon system be implemented across the south leg of the intersection of Bridgewater Street and Arrowwood Lane and b) a rapid rectangular flashing beacon be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.

- Upon completion of the Project, the average trip length to Bellevue, Shaffer and Thomas Olaeta will be reduced and the average trip length to the Project will be low due to its location. Additionally, the proposed Project is located near transit services and adequate pedestrian and bicycle facilities.
- In order to promote alternative modes of transportation, it is recommended that AESD work with the City of Atwater to implement a Safe Routes to School plan and seek grant funding to help build walkways and bikeways where they are lacking within a one-mile radius of the proposed Project site.
- It is recommended that the Project prepare a school signage and striping plan in the vicinity of the Project pursuant to the CA MUTCD Part 3 - Markings and Part 7 - Traffic Control for School Areas, that these be reviewed and approved by the City of Atwater, and subsequently implemented prior to opening day of the Project.
- Under this scenario, all study intersections are projected to operate at an acceptable LOS during both peak periods.

Near Term plus Project Traffic Conditions

- The total trip generation for the Near Term Projects is 9,695 daily trips, 450 AM peak hour trips and 818 PM peak hour trips.
- Under this scenario, the intersection of Sierra Madre Drive and Juniper Avenue is projected to exceed its LOS threshold during the AM peak period only. To improve the LOS at this intersection, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.

Cumulative Year 2040 No Project Traffic Conditions

- Under this scenario, all study intersections are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
  - Bridgewater Street / Juniper Avenue
    - Signalize the intersection with protective left-turn phasing in all directions.

Cumulative Year 2040 plus Project Traffic Conditions

- Under this scenario, all study intersections are projected to exceed their LOS threshold during both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
  - Bridgewater Street / Juniper Avenue
    - Signalize the intersection with protective left-turn phasing in all directions.

Queuing Analysis

- It is recommended that the City consider left-turn and right-turn lane storage lengths as indicated in the Queuing Analysis.

Project's Equitable Fair Share

- It is recommended that the Project contribute its equitable Fair Share as presented in Table IX for those future improvements which are not currently covered by an existing impact fee program or grant funds.

Scope of Work

The TIA focused on evaluating traffic conditions at study intersections that may potentially be impacted by the proposed Project. On December 19, 2019, a Draft Scope of Work for the preparation of a TIA for this Project was provided to City of Atwater, County of Merced and Caltrans staff for their review and comment. Any comments to the proposed Scope of Work were to be provided by January 3, 2020.

On January 17, 2020, JLB followed up with City of Atwater, County of Merced, and Caltrans staff regarding comments to the Draft Scope of Work. On January 21, 2020, the City of Atwater responded to the Draft Scope of Work stating that they needed more time to adequately review the Draft Scope of Work. On January 29, 2020, the City of Atwater responded to the Draft Scope of Work. The City of Atwater provided the following comments: a) AESD and their consultants have not yet made a site plan available for review. Review of the proposed site plan or alternatives may result in additional comments; b) All vehicular circulation and/or waiting/standing for drop-off, pick-up, and parking should take place outside the public rights-of-way of any adjoining streets; c) If preconstruction California Manual of Uniform Traffic Control Devices (CA MUTCD) warrants are not met for the intersection of Juniper and Bridgewater, then following construction and occupancy of the full student body of the proposed school site, this intersection should be evaluated for the installation of pedestrian-activated crossing treatments such as RRFB, HAWK, or similar; d) If the anticipated school boundary changes significantly with regard to major streets or areas of higher/lower student population density after conducting traffic studies or preparing analyses, then the studies or analyses should be updated accordingly, and e) Construction is currently underway at the intersection of Juniper and Buhach, adjacent to Buhach Colony High School. The City has observed that this construction has reduced traffic volumes along Juniper and Buhach, possibly affecting the study area. Adjustments should be estimated and incorporated into any studies. Since County of Merced and Caltrans staff did not provide comments to the Draft Scope of Work, it is assumed that these agencies accepted the Draft Scope of Work as presented.

Based on the comments received, this TIA adjusts existing traffic volumes along Juniper Avenue because of reduced traffic volumes due to construction at the intersection of Juniper Avenue and Buhach Road at the time of the preparation of the Report. The Draft Scope of Work and the comments received from the lead agency and responsible agencies are included in Appendix A.

Study Facilities

The existing peak hour turning movement volume counts were conducted for the study intersections in January 2020 while schools in the vicinity of the proposed Project site were in session. The intersection turning movement counts included pedestrian and bicycle volumes. The traffic counts for the existing study intersections are contained in Appendix B. Due to construction at the intersection of Buhach Road and Juniper Avenue at the time of the preparation of the Report, JLB compared the existing volumes along Juniper Avenue with those utilized in the Buhach-Juniper Commercial Project TIA Report prepared by Arch Beach Consulting dated July 10, 2015 (hereinafter Arch Beach Report). Based on this comparison, the new counts present lower volumes on Juniper Avenue than those used in the Arch Beach Report. To be conservative and adjust for the lower volumes, JLB applied a 3.0 percent average annual growth rate for 5 years to achieve volumes on Juniper Avenue that were higher than those used in the Arch Beach Report. (Note: The average annual growth rate in the vicinity of the proposed Project site was found to be 1.08 percent.) The adjusted existing intersection turning movement volumes, intersection geometrics and traffic controls are illustrated in Figure 2.

Study Intersections

1. Sierra Madre Drive / Juniper Avenue
2. Bridgewater Street / Juniper Avenue

Study Scenarios

Existing Traffic Conditions

This scenario evaluates the Existing Traffic Conditions based on adjusted existing traffic volumes and roadway conditions from traffic counts and field surveys conducted in January 2020.

Existing plus Project Traffic Conditions

This scenario evaluates total traffic volumes and roadway conditions based on the Existing plus Project Traffic Conditions. The Existing plus Project traffic volumes were obtained by adding the Project Only Trips to the Existing Traffic Conditions scenario. The Project Only Trips to the study intersections were based on existing travel patterns, the existing roadway network, data provided by AESD, knowledge of the study area, engineering judgment, existing residential densities, and the City of Atwater 2020 General Plan Circulation Element.

Near Term plus Project Traffic Conditions

This scenario evaluates total traffic volumes and roadway conditions based on the Near Term plus Project Traffic Conditions. The Near Term plus Project traffic volumes were obtained by adding the Near Term related trips to the Existing plus Project Traffic Conditions scenario.

Cumulative Year 2040 No Project Traffic Conditions

This scenario evaluates total traffic volumes and roadway conditions based on the Cumulative Year 2040 No Project Traffic Conditions. The Cumulative Year 2040 No Project traffic volumes were obtained by subtracting the Project Only Trips from the Cumulative Year 2040 plus Project Traffic Conditions scenario.

Cumulative Year 2040 plus Project Traffic Conditions

This scenario evaluates total traffic volumes and roadway conditions based on the Cumulative Year 2040 plus Project Traffic Conditions. The Cumulative Year 2040 plus Project traffic volumes were obtained by expanding the adjusted existing traffic volumes by an average annual growth rate of 1.08 percent for 20 years to arrive at the Cumulative Year 2040 traffic volumes. The average annual growth rate of 1.08 percent was obtained from the Base Year 2015 and Cumulative Year 2042 Merced County Association of Governments (Merced CAG) models. The Merced CAG traffic models are contained in Appendix C.

Level of Service Analysis Methodology

Level of Service (LOS) is a qualitative index of the performance of an element of the transportation system. LOS is a rating scale running from "A" to "F", with "A" indicating no congestion of any kind and "F" indicating unacceptable congestion and delays. LOS in this study describes the operating conditions for signalized and unsignalized intersections.

The *Highway Capacity Manual* (HCM) 6th Edition is the standard reference published by the Transportation Research Board and contains the specific criteria and methods to be used in assessing LOS. U-turn movements were analyzed using HCM 2000 methodologies and would yield more accurate results since HCM 6th Edition methodologies do not allow the analysis of U-turns. Synchro software was used to define LOS in this study. Details regarding these calculations are included in Appendix D.

Criteria of Significance

The City of Atwater 2020 General Plan has established LOS D as the acceptable level of traffic congestion for all streets and highway systems within the City. Therefore, the LOS D threshold was utilized to evaluate the potential significance of LOS impacts to City of Atwater roadway facilities.

The County of Merced has established the following LOS threshold for the detailed areas: a) LOS C for roadways located within rural areas; b) LOS D for roadways located outside Urban Communities that serve as connectors between Urban Communities; and c) LOS D for roadways located within Urban Communities. Hence, LOS D is used to evaluate the potential significance of LOS impacts to Merced County intersections that fall within Urban Communities. In this case, all study facilities fall within the City of Atwater SOI. Therefore, the City of Atwater LOS threshold is utilized.

Caltrans endeavors to maintain a target LOS at the transition between LOS C and D on State highway facilities consistent with the *Caltrans Guide for the Preparation of Traffic Impact Studies* dated December 2002. However, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS. In this TIA, however, all study facilities fall within the City of Atwater SOI. Therefore, the City of Atwater LOS threshold is utilized.

Operational Analysis Assumptions and Defaults

The following operational analysis values, assumptions and defaults were used in this study to ensure a consistent analysis of LOS among the various scenarios.

- Yellow time consistent with the CA MUTCD based on approach speeds
- Yellow time of 3.2 seconds for left-turn phases
- All-red clearance intervals of 1.0 second for all phases
- Walk intervals of 7.0 seconds
- Flashing Don't Walk based on 3.5 feet/second walking speed with yellow plus all-red clearance subtracted and 2.0 seconds added
- All new or modified signals utilize protective left-turn phasing
- A 1 percent heavy vehicle factor along Sierra Madre Drive and Bridgewater Street
- A 3 percent heavy vehicle factor along Juniper Avenue
- The number of observed pedestrians at existing intersections was utilized under all baseline study scenarios.
- An average of 10 pedestrian calls per hour at the intersection of Bridgewater Street and Juniper Avenue due to its proximity to the proposed Project site
- At existing intersections, the observed approach Peak Hour Factor (PHF) is utilized in the Existing scenario.
- At existing intersections, the following PHFs are utilized in the Existing plus Project and Near Term plus Project scenarios. The PHFs were established based on historical traffic counts collected by JLB for intersections in proximity of schools and engineering judgement.
    - A PHF of 0.82 during the AM peak
    - A PHF of 0.84 during the PM peak
- At existing intersections, a PHF of 0.92, or the existing PHF if higher, is utilized in the Cumulative Year 2040 No Project scenario
- At existing intersections, the following PHFs are utilized in the Cumulative Year 2040 plus Project scenario. As roadways start to reach their saturated flow rates, PHFs tend to increase to 0.90 or higher. The PHFs were established based on historical traffic counts collected by JLB for intersections in proximity of schools.
    - A PHF of 0.86 during the AM peak
    - A PHF of 0.90 during the PM peak

Existing Traffic Conditions

Roadway Network

The Project site and surrounding study area are illustrated in Figure 1. Important roadways serving the Project are discussed below.

Sierra Madre Drive is an existing north-south two-lane undivided local roadway in the vicinity of the proposed Project site. North of Juniper Avenue, Sierra Madre Drive exists as a two-lane undivided local roadway and provides access to a gated, multifamily residential neighborhood. South of Juniper Avenue, Sierra Madre Drive exists as a two-lane undivided local roadway for approximately 900 feet and provides access to a single-family residential neighborhood. The City of Atwater 2020 General Plan Circulation Element designates Sierra Madre Drive as a two-lane undivided local roadway through the City of Atwater SOI.

Bridgewater Street is an existing north-south two-lane undivided local roadway adjacent to the proposed Project site. In this area, Bridgewater Street exists as a two-lane undivided local roadway for approximately 1,800 feet north of Juniper Avenue. The City of Atwater 2020 General Plan Circulation Element designates Bridgewater Street as two-lane undivided local roadway through the City of Atwater SOI.

Juniper Avenue is an existing east-west four-lane collector adjacent to the proposed Project site. In this area, Juniper Avenue exists a two-lane undivided collector between Winton Way and Shaffer Road, a four-lane collector divided by a two-way left-turn lane between Shaffer Road and Valley Street, a four-lane divided collector between Valley Street and Buhach Road. East of Buhach Road, Juniper Avenue is known as Avenue Two. The City of Atwater 2020 General Plan Circulation Element designates Juniper Avenue as a two-lane urban connector between Winton Way and Buhach Road. However, the segment of Juniper Avenue between Shaffer Road and Buhach Road is currently constructed as a four-lane divided collector.

Traffic Signal Warrants

Peak hour traffic signal warrants, as appropriate, were prepared for the unsignalized intersections in the Existing Traffic Conditions scenario. These warrants are found in Appendix J. These warrants were prepared pursuant to the CA MUTCD guidelines for the preparation of traffic signal warrants. Under this scenario, none of the unsignalized study intersections satisfy the peak hour traffic signal warrant during either peak period. Based on the traffic signal warrants and engineering judgement, signalization of these intersections is not recommended, especially since they operate at an acceptable LOS during both peak periods.

Results of Existing Level of Service Analysis

Figure 2 illustrates the Existing Traffic Conditions turning movement volumes, intersection geometrics and traffic controls. LOS worksheets for the Existing Traffic Conditions scenario are provided in Appendix E. Table I presents a summary of the Existing peak hour LOS at the study intersections.

At present, all study intersections operate at an acceptable LOS during both peak periods.

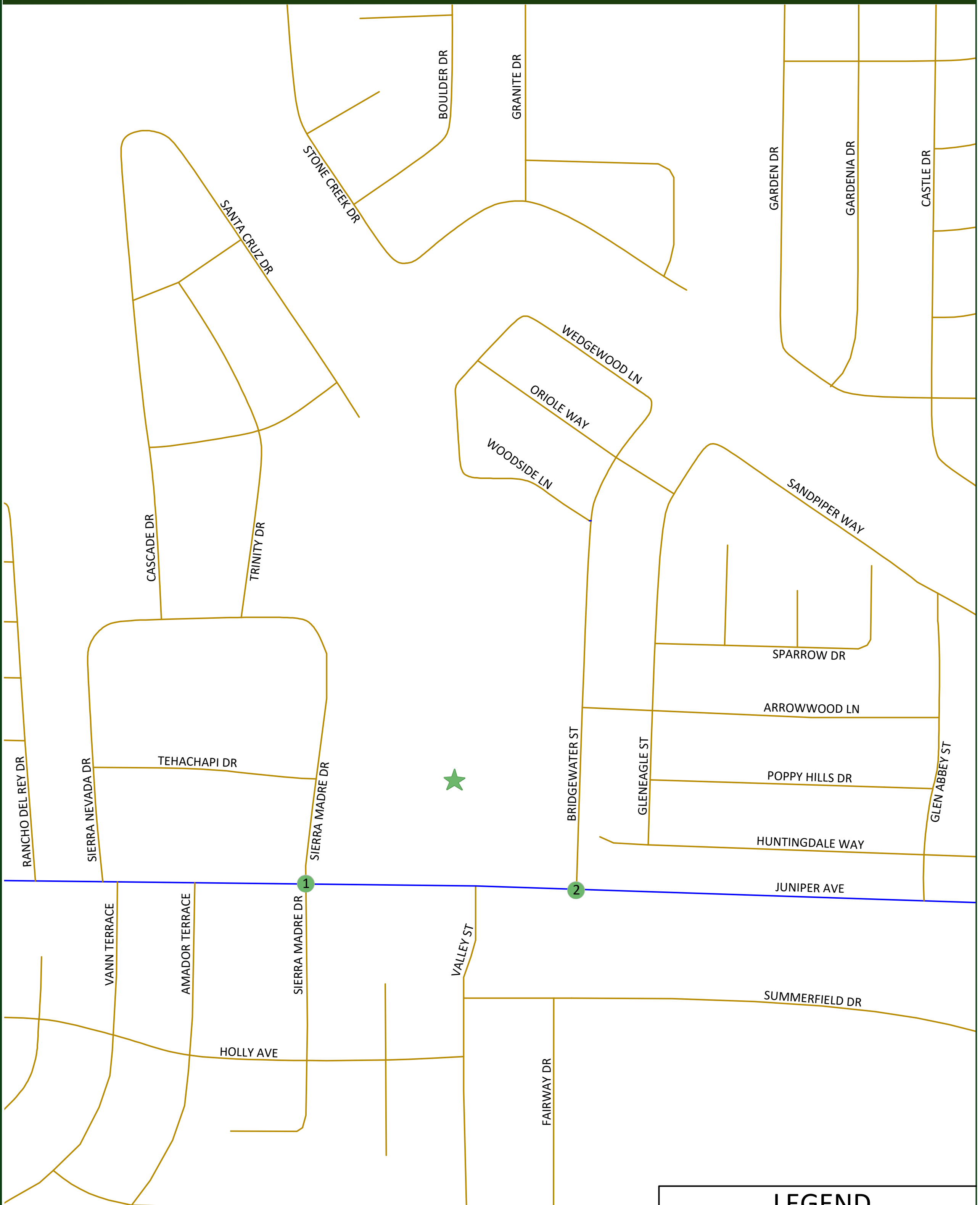
Table I: Existing Intersection LOS Results

ID	*Intersection*	*Intersection Control*	*AM (7-9) Peak Hour*		*PM (2-4) Peak Hour*	
			Average Delay (sec/veh)	*LOS*	*Average Delay (sec/veh)*	*LOS*
1	Sierra Madre Drive / Juniper Avenue	Two-Way Stop	21.9	C	17.6	C
2	Bridgewater Street / Juniper Avenue	One-Way Stop	14.7	B	12.7	B

Note: LOS = Level of Service based on average delay on signalized intersections and All-Way STOP Controls
LOS for two-way and one-way STOP controlled intersections are based on the worst approach/movement of the minor street.

AESD Elementary School TIA - City of Atwater
Vicinity Map

Figure 1



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516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

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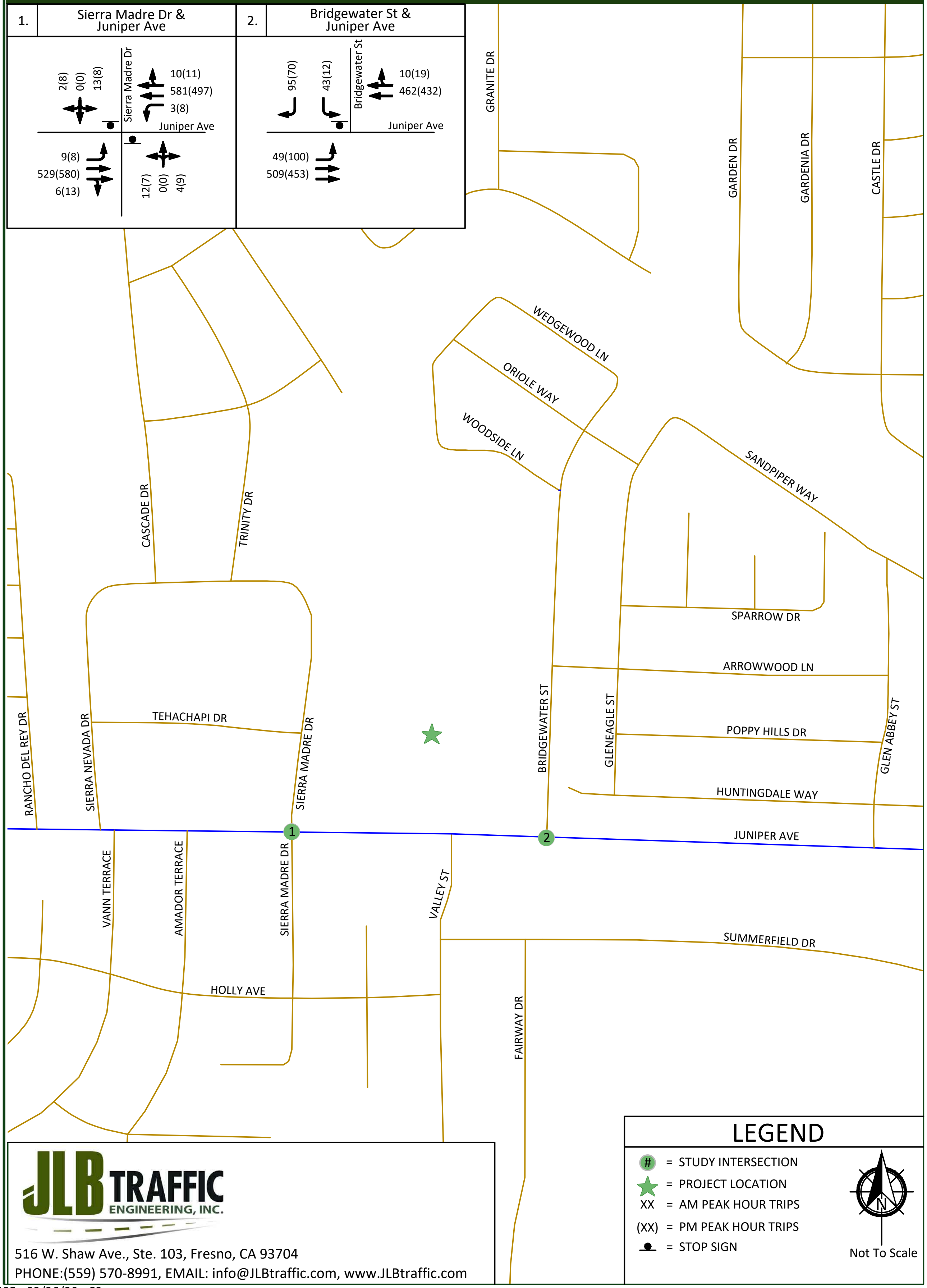
AESD Elementary School TIA - City of Atwater
Existing - Traffic Volumes, Geometrics and Controls

Figure 2



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516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

Existing plus Project Traffic Conditions

Project Description

The Project proposes to build an elementary school estimated to serve up to 600 students. Based on data provided by AESD, the Project is within a defined service area that is currently being served by other schools – Bellevue, Shaffer, and Thomas Olaeta. Based on information provided to the JLB, the Project is consistent with the City of Atwater 2020 General Plan. Figure 3 illustrates the latest Project Site Plan.

Project Access

Based on the latest Project Site Plan, access to and from the Project site will be from five (5) access points located along the west side of Bridgewater Street and north side of Juniper Avenue. Access to Bridgewater will be from three (3) points located approximately 525 feet (full access), 325 feet (bus only entrance) and 125 feet (bus only exit) north of Juniper Avenue. Access to Juniper Avenue will be from two (2) points located approximately 750 feet (exit-only) and 200 feet (entrance-only) west of Bridgewater Street.

JLB analyzed a prior version of the Project Site Plan after which it was recommended that the Project exit-only driveway along Juniper Avenue be widened to accommodate a southbound left-turn lane and dedicated right-turn lane and maintain a minimum throat depth of 60 feet before any vehicular openings to the east side of the parking lot. Furthermore, it was recommended that eastbound to westbound U-turns be accommodated at the intersection of Bridgewater Street and Juniper Avenue. The latest Project Site Plan addresses these recommendations. Furthermore, JLB analyzed the location of the proposed access points relative to the existing local roads and driveways in the Project's vicinity. A review of the access points to be constructed indicates that they are located at points that minimize traffic operational impacts to the existing roadway network.

Trip Generation

Trip generation rates for the proposed Project were obtained from the 10th Edition of the Trip Generation Manual published by the Institute of Transportation Engineers (ITE). Table II presents the trip generation for the proposed Project with trip generation rates for 600 Elementary School students. At build-out, the Project is estimated to generate a maximum of 1,134 daily trips, 402 AM peak hour trips and 204 PM peak hour trips.

Table II: Project Trip Generation

Land Use (ITE Code)	*Size*	*Unit*	*Daily*		*AM (7-9) Peak Hour*						*PM (2-4) Peak Hour*					
			Rate	*Total*	*Trip Rate*	*In* %	*Out* %	*In*	*Out*	*Total*	*Trip Rate*	*In* %	*Out* %	*In*	*Out*	*Total*
Elementary School (520)	600	students	1.89	1,134	0.67	54	46	217	185	402	0.34	45	55	92	112	204
Total Project Trips				**1,134**				**217**	**185**	**402**				**92**	**112**	**204**

Trip Distribution

The trip distribution assumptions were developed based on existing travel patterns, the existing roadway network, data provided by AESD, knowledge of the study area, engineering judgment, existing residential densities, and the City of Atwater 2020 General Plan Circulation Element. Figure 4 illustrates the Project Only Trips to the study intersections.

Bikeways

Currently, bike lanes exist adjacent to the proposed Project site along Juniper Avenue. Juniper Avenue contains a Class III Bike Route west of Sierra Madre Drive and a Class I Bike Path along the north side between Sierra Madre Drive and Augusta Lane. The City of Atwater 2020 General Plan Circulation Element recommends a Class I Bike Path along the north side of Juniper Avenue between Sierra Madre Drive and Buhach Road and a Class III Bike Route along Juniper Avenue west of Sierra Madre Drive. The latest Project Site Plan retains the existing Class I Bike Path along its frontage to Juniper Avenue.

Walkways

Currently, walkways exist adjacent to the proposed Project site along Sierra Madre Drive, Juniper Avenue and Bridgewater Street. Pedestrian facilities in the form of sidewalks built to current City of Atwater standards within and around the proposed Project site provide enhanced safety to those students who walk to and from the proposed Project site. Therefore, it is recommended that the Project retain existing ADA compliant walkways along its frontages to Bridgewater Street and Juniper Avenue. The latest Project Site Plan includes on-site pedestrian features and high-visibility crosswalks across the north leg and west leg of the intersection of Bridgewater Street and Juniper Avenue. It is recommended that a) a high-visibility crosswalk with a rapid rectangular flashing beacon system be implemented across the south leg of the intersection of Bridgewater Street and Arrowwood Lane and b) a rapid rectangular flashing beacon be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.

Transit

The Bus, sponsored by Merced County Transit, provides fixed-route and paratransit service in the City of Atwater. At present, The Bus Route A1 (Atwater Loop) operates adjacent to the proposed Project site.

Route A1 operates at 60-minute intervals on weekdays and weekends and its nearest stop to the Project site is located along the north side of Juniper Avenue approximately 50 feet west of Bridgewater Street. This route provides a direct connection to Jack-in-the-Box, Atwater Community Center, Castle Human Services Agency, Castle Clinic, Castlewood Castle Park, and Anberry Outpatient. Retention of the existing and expansion of future transit routes is dependent on transit ridership demand and available funding.

Paratransit is a complimentary curb-to-curb transit service that requires customers to make a reservation to get service. It is not a taxi service, but a shared ride public transportation service where you and others are assigned bust service according to where you want to ho. Paratransit service is available in every city, community and township in Merced County, but is limited for the use of persons with disabilities who are unable to navigate the fixed route services of The Bus without special assistance. Paratransit is open for service between 6:00 AM and 8:00 PM on weekdays and 8:00 AM and 6:00 PM on weekends.

Vehicle Miles Traveled Analysis

Senate Bill (SB) 743 (Steinberg 2013) was approved by then Governor Brown on September 27, 2013. SB 743 created a path to revise the definition of transportation impacts according to CEQA. The revised CEQA Guidelines requiring Vehicle Miles Traveled (VMT) Analysis became effective December 28, 2018. However, agencies have until July 1, 2020 to finalize their local guidelines on VMT Analysis. Therefore, as agencies finalize their VMT Analysis protocol, CEQA transportation impacts are to be determined using LOS of intersections and roadways, which is a measure of congestion. The intent of SB 743 is to align CEQA transportation study methodology with and promote the statewide goals and policies of reducing VMT and greenhouse gases (GHG). Three objectives of SB 743 related to development are to reduce GHG, diversify land uses, and focus on creating a multimodal environment. It is hoped that this will spur infill development.

The Technical Advisory on Evaluating Transportation Impacts in CEQA published by the Governor's Office of Planning and Research (OPR) dated December 2018 acknowledges that lead agencies should set criteria and thresholds for VMT and transportation impacts. However, the Technical Advisory provides guidance to residential, office and retail land uses citing these as the most common. Beyond the three most common land uses, no other guidance is provided. The Technical Advisory also notes that land uses may have a less than significant impact if located within low VMT areas of a region. Screening maps are suggested for this determination.

VMT is simply the product of a number of trips and the length of those trips. The first step in a VMT analysis is to establish the baseline average VMT, which requires the definition of a region. The Technical Advisory states that existing VMT may be measured at the regional or city level. On the contrary, the Technical Advisory also notes that VMT analyses should not be truncated due to "jurisdictional or other boundaries."

Based on data provided by AESD, the Project site is located within a defined service area that is currently being served by other schools – Bellevue, Shaffer, and Thomas Olaeta. When this is considered, the estimated average trip length (one-way) for students within the proposed Project attendance boundary to: a) Bellevue is 1.68 miles; b) Shaffer is 2.10 miles; and c) Thomas Olaeta is 2.00 miles. For comparison, the Project's estimated average trip length (one-way) is 1.10 miles. Upon completion of the Project, the average trip length to Bellevue, Shaffer and Thomas Olaeta will be reduced and the average trip length to the Project will be low due to its location. Additionally, the proposed Project is located near transit services and adequate pedestrian and bicycle facilities. In the near future, the City of Atwater may wish to coordinate with Merced CAG and develop criteria and thresholds that balance the direction from OPR and the goals of SB 743 with the vision for the City of Atwater and economic development, affordable housing, access to goods and services, and overall quality of life.

Safe Routes to School

The most direct path to the Project site for students residing on the northwest quadrant of Sierra Madre Drive and Juniper Avenue would be to head east toward Sierra Madre Drive and south toward Juniper Avenue. Students may utilize the local streets to arrive at Sierra Madre Drive and Juniper Avenue. The local streets in the area are controlled by one-way and two-way stops, contain unmarked crosswalks on all approaches, and contain pedestrian walkways. The intersection of Sierra Madre Drive and Juniper Avenue is controlled by a two-way stop on Sierra Madre Drive and contains a high-visibility crosswalk across the west leg. Students may proceed to cross Sierra Madre Drive along the north side of Juniper Avenue and continue east until reaching the nearest campus entrance.

The most direct path to the Project site for students residing on the southwest quadrant of Bridgewater Street and Juniper Avenue would be to head east toward Valley Street and north toward Juniper Avenue. Students may utilize the local streets to arrive at Valley Street and Juniper Avenue. Local streets in the area (e.g., Sierra Madre Drive, Holly Avenue, Summerfield Drive, Fairway Drive, etc.) are controlled by one-way and two-way stops, contain unmarked crosswalks on all approaches, and contain pedestrian walkways. The intersection of Valley Street and Juniper Avenue is controlled by a one-way stop on Juniper Avenue and contains unmarked crosswalks on all approaches. Students may proceed east toward the intersection of Bridgewater Street and Juniper Avenue. The intersection of Bridgewater Street and Juniper Avenue is controlled by a one-way stop on Bridgewater Street and contains a marked crosswalk across the north leg. Students may proceed to cross Juniper Avenue along the west side of Bridgewater Street and continue west or north until reaching the nearest campus entrance.

The most direct path to the Project site for students residing north of the intersection of Bridgewater Street and Juniper Avenue would be to head west or east toward Bridgewater Street and south or north toward Arrowwood Lane. Students may utilize the local streets to arrive at Bridgewater Street and Arrowwood Lane. Local streets in the area (e.g., Oriole Way, Sandpiper Way, Gleneagle Street, Glen Abbey Street, Arrowwood Lane, Poppy Hills Drive, Huntingdale Way, etc.) are controlled by one-way and two-way stops, contain unmarked crosswalks on all approaches, and contain pedestrian walkways. The intersection of Bridgewater Street and Arrowwood Lane is controlled by a one-way stop on Arrowwood Lane and contains unmarked crosswalks on all approaches. Students on the west side of Bridgewater Street may continue south until reaching the nearest campus entrance. Students on the east side of Bridgewater Street and Arrowwood Lane may proceed to cross Arrowwood Lane and Bridgewater Street and continue south until reaching the nearest campus entrance.

The most direct path to the Project site for students residing southeast of the intersection of Bridgewater Street and Juniper Avenue would be to head west toward Bridgewater Street and north toward Juniper Avenue. Students may utilize a combination of major roads and local streets to arrive at Bridgewater Street and Juniper Avenue. The major roads and local streets (e.g., Avenue Two, Avenue One, Buhach Road, August Lane, etc.) are signalized, contain marked crosswalks on all approaches, and contain pedestrian walkways. The intersection of Bridgewater Street and Juniper Avenue is controlled by a one-way stop on Bridgewater Street and contains a marked crosswalk across the north leg. Students may proceed to cross Juniper Avenue along the west side of Bridgewater Street and continue west or north until reaching the nearest campus entrance.

Most of the areas are well-developed with walkways and intersection controls, but there are a few exceptions. Therefore, in order to promote alternative modes of transportation, it is recommended that AESD work with the City of Atwater to implement a Safe Routes to School plan and seek grant funding to help build walkways and bikeways where they are lacking within a one-mile radius of the proposed Project site. It is also recommended that the Project prepare a school signage and striping plan in the vicinity of the Project pursuant to the CA MUTCD Part 3 - Markings and Part 7 - Traffic Control for School Areas, that these be reviewed and approved by the City of Atwater, and subsequently implemented prior to opening day of the school component of the Project.

Traffic Signal Warrants

Peak hour traffic signal warrants, as appropriate, were prepared for the unsignalized intersections in the Existing plus Project Traffic Conditions scenario. These warrants are found in Appendix J. These warrants were prepared pursuant to the CA MUTCD guidelines for the preparation of traffic signal warrants. Under this scenario, the intersection of Bridgewater Street and Juniper Avenue is projected to satisfy the peak hour traffic signal warrant during the AM peak period only. Based on the traffic signal warrants and engineering judgement, signalization of this intersection is not recommended, especially since this intersection is projected to operate at an acceptable LOS during both peak periods. It is also worth noting that the CA MUTCD states “satisfaction of a signal warrant or warrants shall not in itself require the installation of a traffic signal.” Therefore, it is recommended that prior to the installation of a traffic signal, investigation of CA MUTCD warrants 4 and 7, as applicable, be conducted for this intersection.

Results of Existing plus Project Level of Service Analysis

The Existing plus Project Traffic Conditions scenario assumes that the existing roadway geometrics and traffic controls will remain in place. Figure 5 illustrates the Existing plus Project turning movement volumes, intersection geometrics and traffic controls. LOS worksheets for the Existing plus Project Traffic Conditions scenario are provided in Appendix F. Table III presents a summary of the Existing plus Project peak hour LOS at the study intersections.

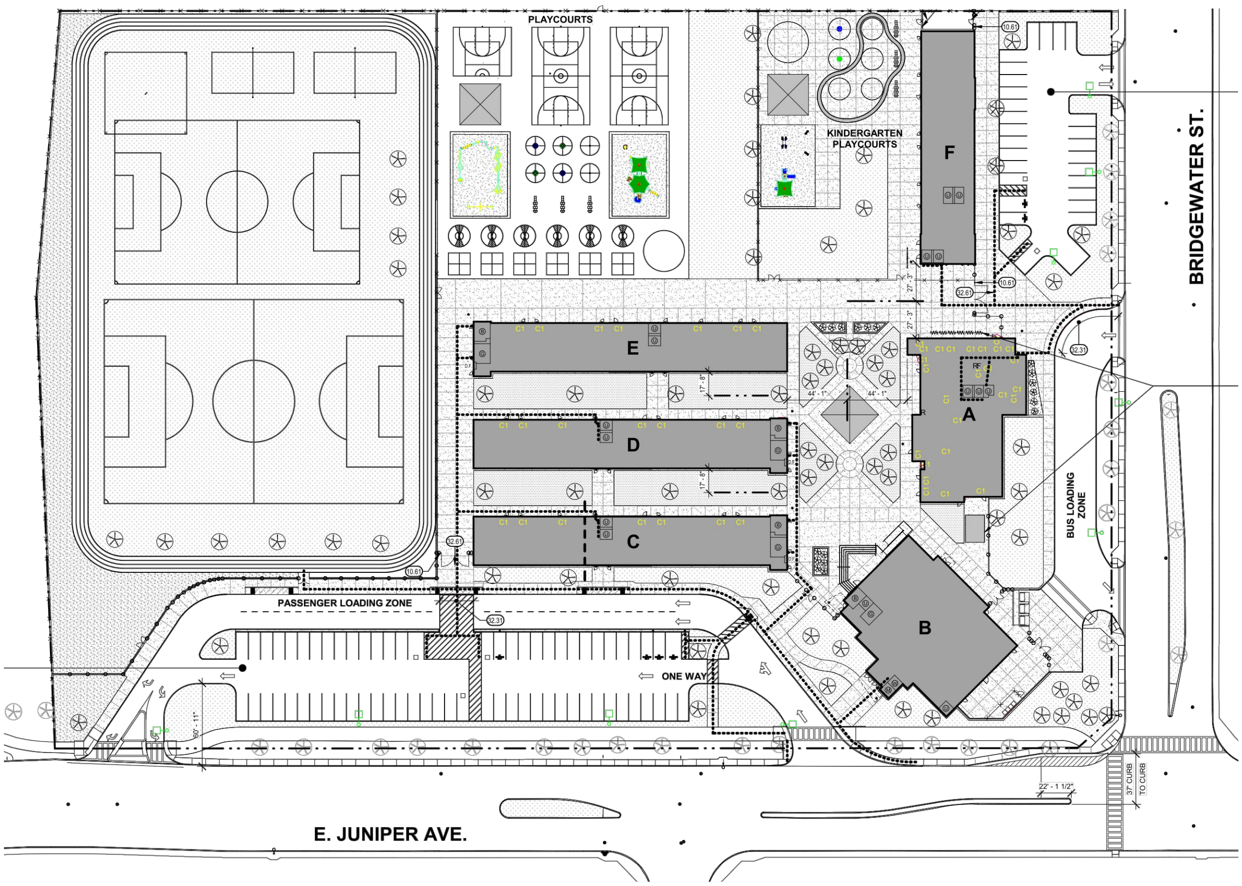
Under this scenario, all study intersections are projected to operate at an acceptable LOS during both peak periods.

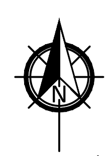
Table III: Existing plus Project Intersection LOS Results

ID	Intersection	Intersection Control	AM (7-9) Peak Hour		PM (2-4) Peak Hour	
			Average Delay (sec/veh)	LOS	Average Delay (sec/veh)	LOS
1	Sierra Madre Drive / Juniper Avenue	Two-Way Stop	33.4	D	20.1	C
2	Bridgewater Street / Juniper Avenue	One-Way Stop	25.9	D	18.8	C

Note: LOS = Level of Service based on average delay on signalized intersections and All-Way STOP Controls
LOS for two-way and one-way STOP controlled intersections are based on the worst approach/movement of the minor street.

Figure 3





Not To Scale

516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
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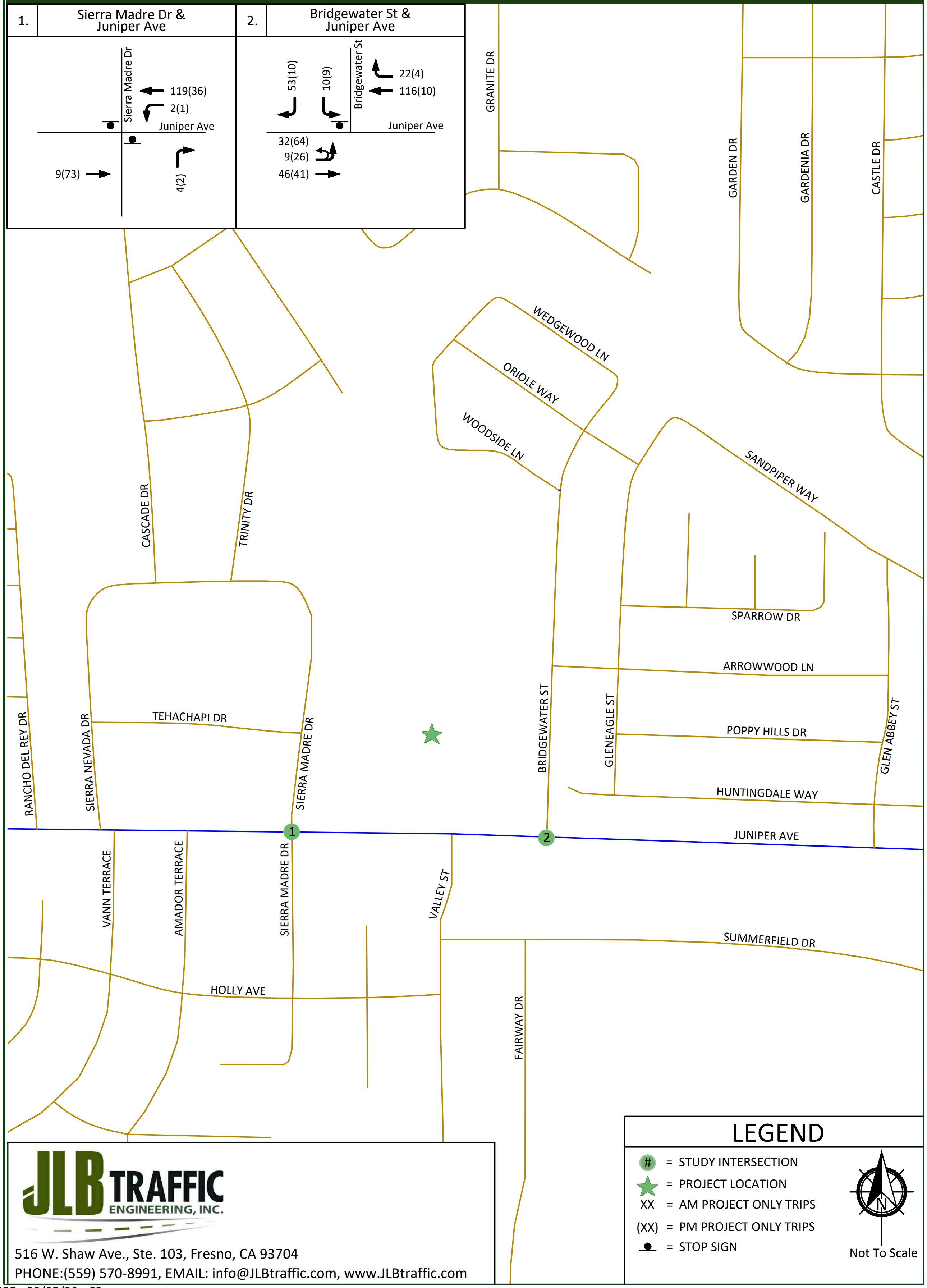
AESD Elementary School TIA - City of Atwater
Project Only Trips

Figure 4



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516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

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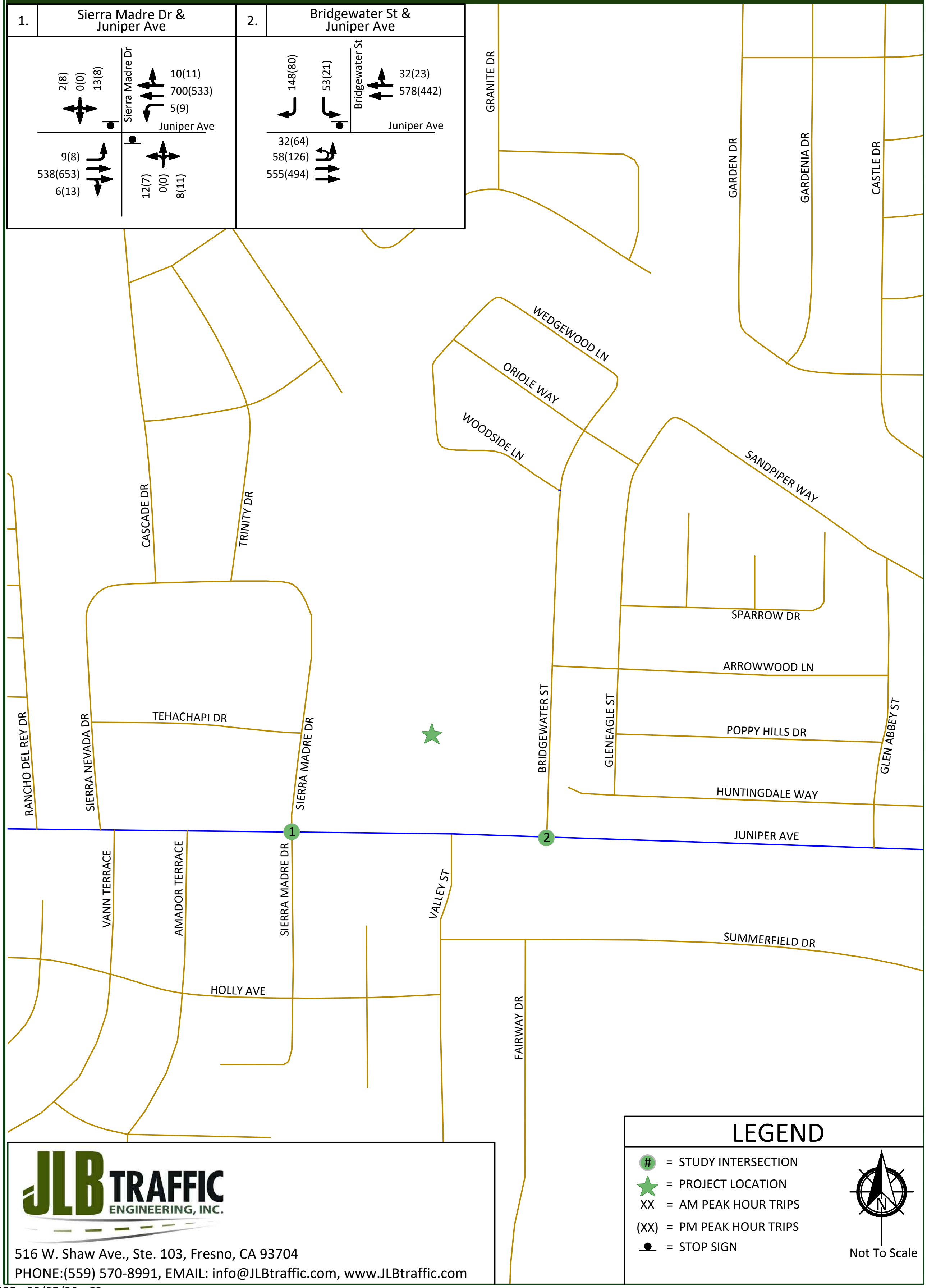
AESD Elementary School TIA - City of Atwater

Existing plus Project - Traffic Volumes, Geometrics and Controls

Figure 5



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516 W. Shaw Ave., Ste. 103, Fresno, CA 93704

PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

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Near Term plus Project Traffic Conditions

Description of Near Term Projects

Near Term Projects are approved and/or known Projects that are either under construction, built but not fully occupied, are not built but have final site development review (SDR) approval, or for which the lead agency or responsible agencies have knowledge of. The City of Atwater, County of Merced and Caltrans staff were consulted throughout the preparation of this TIA regarding Near Term Projects that could potentially impact the study intersections. JLB staff conducted a reconnaissance of the surrounding area to confirm the Near Term Projects. Therefore, the projects listed in Table IV were approved, near approval, or in the pipeline within the proximity of the proposed Project.

The trip generation listed in Table IV is that which is anticipated to be added to the streets and highways by the Near Term Projects between the time of the preparation of this Report and five years after buildout of the proposed Project. As shown in Table IV, the total trip generation for the Near Term Projects is 9,695 daily trips, 450 AM peak hour trips and 818 PM peak hour trips. Figure 6 illustrates the location of the Near Term Projects and their combined trip assignment to the study intersections.

Table IV: Near Term Projects' Trip Generation

ID	*Approved or Pipeline Project Name*	*Daily Trips*	*AM Peak Hour*	*PM Peak Hour*
A	Buhach Road/Juniper Avenue Commercial Development[1]	3,311	152	223
B	Buhach Road/Avenue One Commercial Development2	453	11	46
C	Ferrari Annexation, General Plan Amendment & Planned Development Master Plan[1]	5,931	287	549
Total Near Term Project Trips		**9,695**	**450**	**818**

Note: 1 = Trip Generation based on Arch Beach Consulting Traffic Impact Analysis Report
2 = Trip Generation based on JLB Traffic Engineering, Inc. Traffic Impact Analysis Report
3 = Trip Generation based on KD Anderson & Associates, Inc. Traffic Impact Analysis Report

Traffic Signal Warrants

Peak hour traffic signal warrants, as appropriate, were prepared for the unsignalized intersections in the Near Term plus Project Traffic Conditions scenario. These warrants are found in Appendix J. These warrants were prepared pursuant to the CA MUTCD guidelines for the preparation of traffic signal warrants. Under this scenario, the intersection of Bridgewater Street and Juniper Avenue is projected to satisfy the peak hour traffic signal warrant during the AM peak period only. Based on the traffic signal warrants and engineering judgement, signalization of this intersection is not recommended, especially since this intersection is projected to operate at an acceptable LOS during both peak periods. It is also worth noting that the CA MUTCD states "satisfaction of a signal warrant or warrants shall not in itself require the installation of a traffic signal." Therefore, it is recommended that prior to the installation of a traffic signal, investigation of CA MUTCD warrants 4 and 7, as applicable, be conducted for this intersection.

Results of Near Term plus Project Level of Service Analysis

The Near Term plus Project Traffic Conditions scenario assumes that the existing roadway geometrics and traffic controls will remain in place. Figure 7 illustrates the Near Term plus Project turning movement volumes, intersection geometrics and traffic controls. LOS worksheets for the Near Term plus Project Traffic Conditions scenario are provided in Appendix G. Table V presents a summary of the Near Term plus Project peak hour LOS at the study intersections.

Under this scenario, the intersection of Sierra Madre Drive and Juniper Avenue is projected to exceed its LOS threshold during the AM peak period only. To improve the LOS at this intersection, it is recommended that the following improvements be implemented.

- Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.

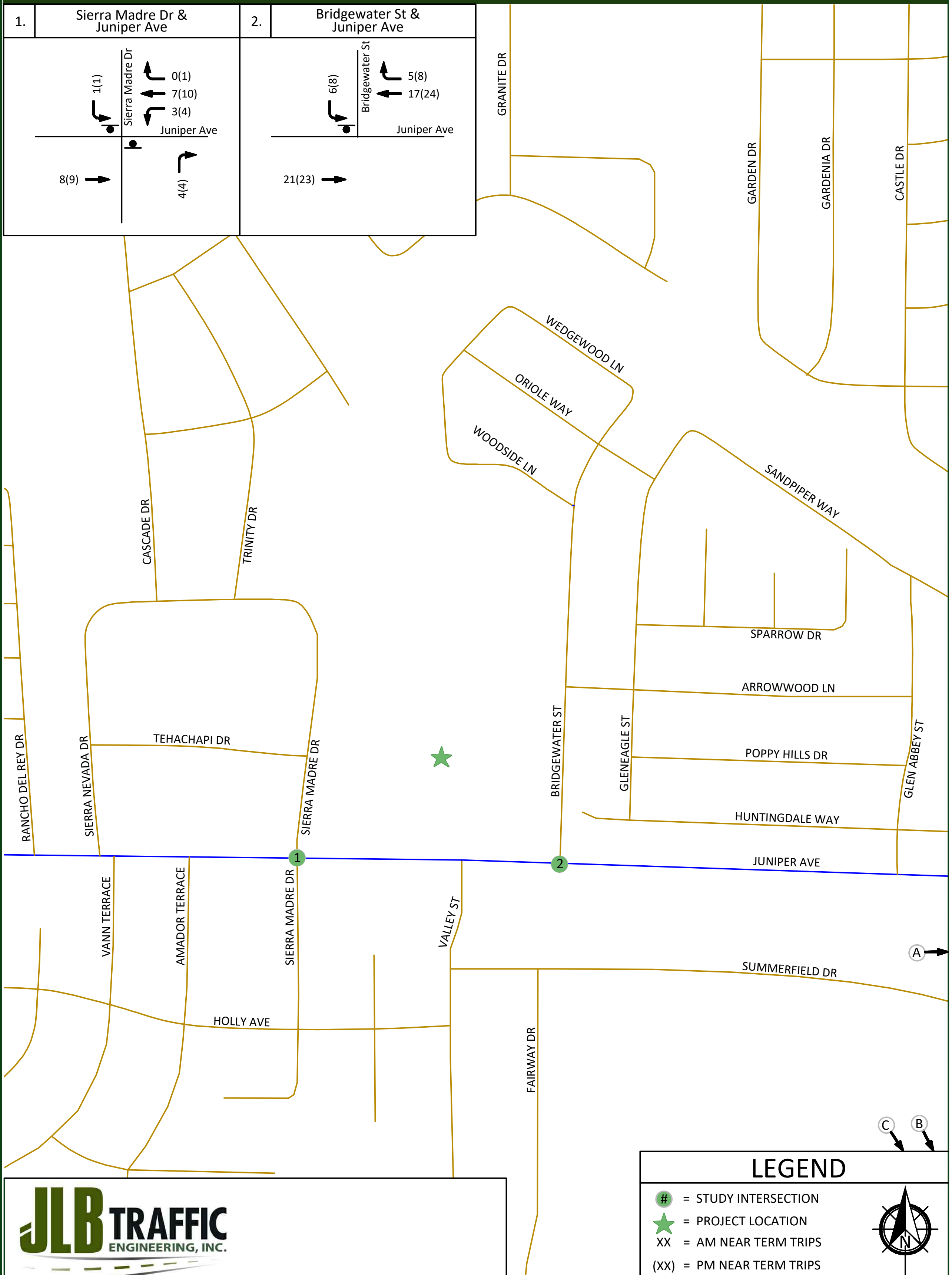
Table V: Near Term plus Project Intersection LOS Results

ID	Intersection	Intersection Control	AM (7-9) Peak Hour		PM (2-4) Peak Hour	
			Average Delay (sec/veh)	LOS	Average Delay (sec/veh)	LOS
1	Sierra Madre Drive / Juniper Avenue	Two-Way Stop	**35.3**	**E**	21.5	C
		Two-Way Stop (Mitigated)	11.4	B	11.4	B
2	Bridgewater Street / Juniper Avenue	One-Way Stop	30.8	D	24.3	C

Note: LOS = Level of Service based on average delay on signalized intersections and All-Way STOP Controls
LOS for two-way and one-way STOP controlled intersections are based on the worst approach/movement of the minor street.

AESD Elementary School TIA - City of Atwater
Near Term Projects' Trip Assignment

Figure 6



516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
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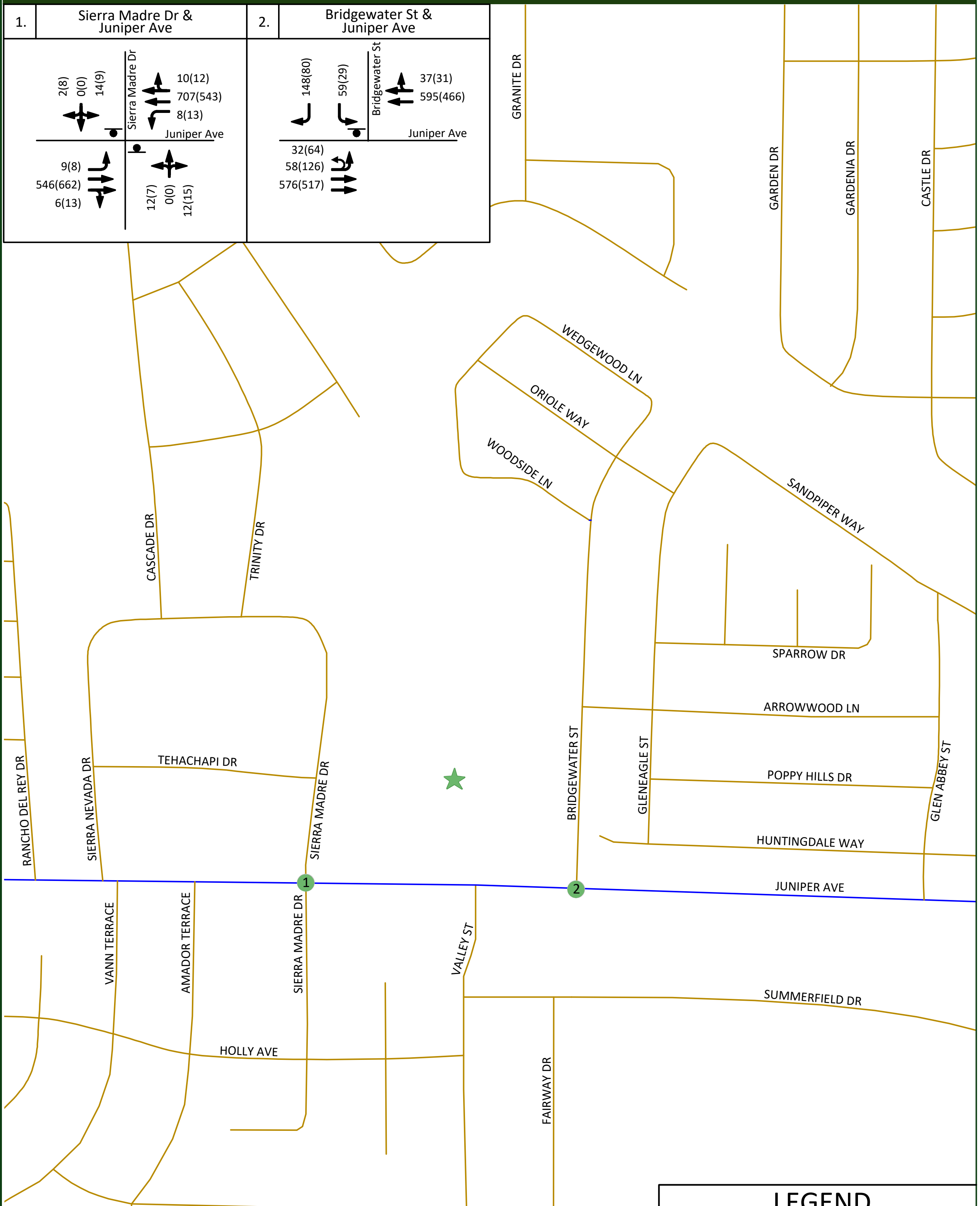
AESD Elementary School TIA - City of Atwater
Near Term plus Project - Traffic Volumes, Geometrics and Controls

Figure 7



JLB TRAFFIC ENGINEERING, INC.
516 W. Shaw Ave., Ste. 103, Fresno, CA 93704
PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

005-005 - 08/05/20 - CS/JG

Cumulative Year 2040 No Project Traffic Conditions

Traffic Signal Warrants

Peak hour traffic signal warrants, as appropriate, were prepared for the unsignalized intersections in the Cumulative Year 2040 No Project Traffic Conditions scenario. These warrants are found in Appendix J. These warrants were prepared pursuant to the CA MUTCD guidelines for the preparation of traffic signal warrants. Under this scenario, the intersection of Bridgewater Street and Juniper Avenue is projected to satisfy the peak hour traffic signal warrant during both peak periods. Based on the traffic signal warrants and engineering judgement, signalization of this intersection is recommended.

Results of Cumulative Year 2040 No Project Level of Service Analysis

The Cumulative Year 2040 No Project Traffic Conditions scenario assumes that the existing roadway geometrics and traffic controls will remain in place. Figure 8 illustrates the Cumulative Year 2040 No Project turning movement volumes, intersection geometrics and traffic controls. LOS worksheets for the Cumulative Year 2040 No Project Traffic Conditions scenario are provided in Appendix H. Table VI presents a summary of the Cumulative Year 2040 No Project peak hour LOS at the study intersections.

Under this scenario, all study intersections are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.

- Sierra Madre Drive / Juniper Avenue
  - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
- Bridgewater Street / Juniper Avenue
  - Signalize the intersection with protective left-turn phasing in all directions.

Table VI: Cumulative Year 2040 No Project Intersection LOS Results

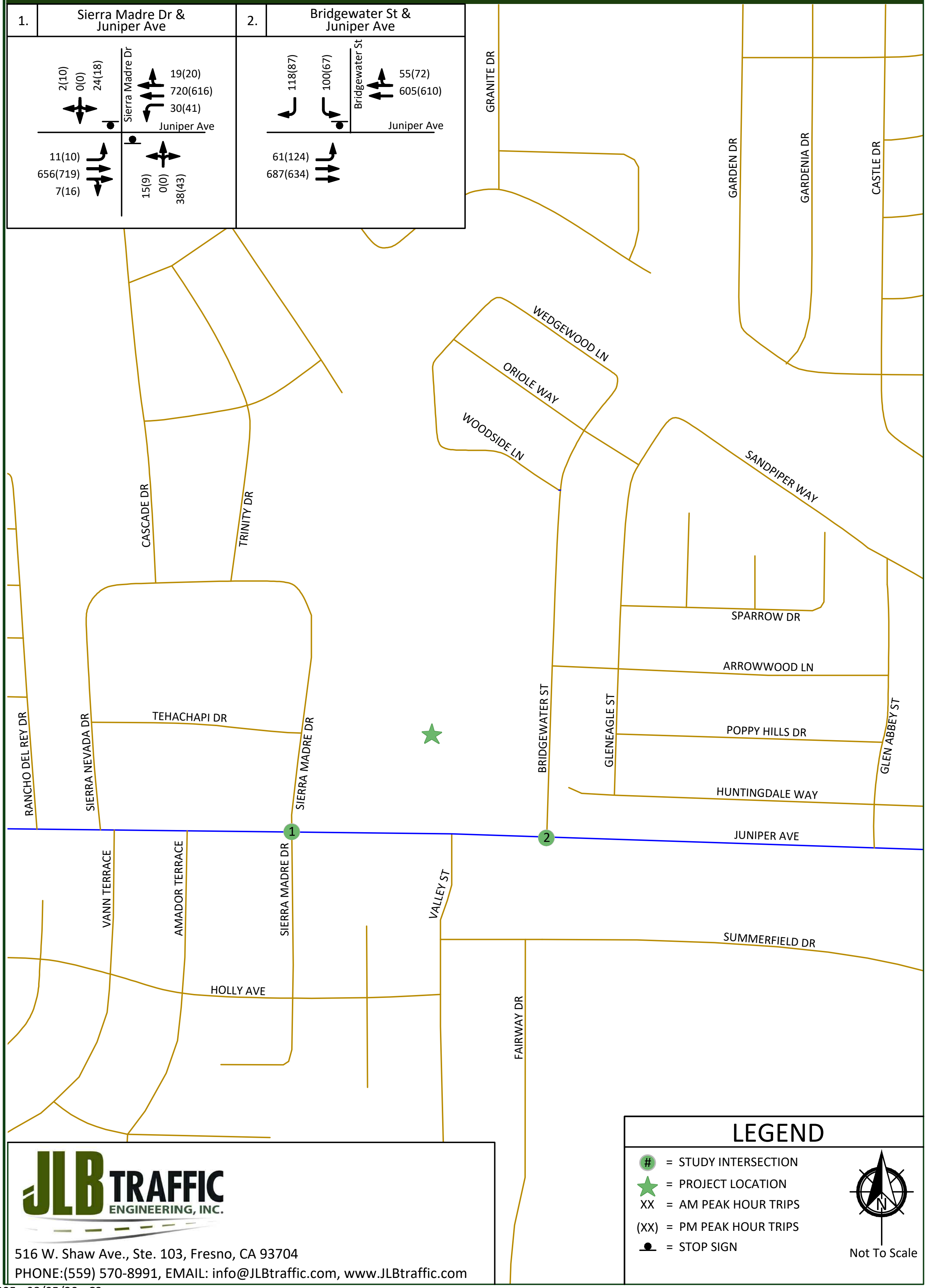
ID	*Intersection*	*Intersection Control*	*AM (7-9) Peak Hour*		*PM (2-4) Peak Hour*	
			Average Delay (sec/veh)	*LOS*	*Average Delay (sec/veh)*	*LOS*
1	Sierra Madre Drive / Juniper Avenue	Two-Way Stop	**42.0**	**E**	30.6	D
		Two-Way Stop (Improved)	11.2	B	11.8	B
2	Bridgewater Street / Juniper Avenue	One-Way Stop	**35.0**	**E**	**38.6**	**E**
		Signalized (Improved)	7.7	A	8.1	A

Note: LOS = Level of Service based on average delay on signalized intersections and All-Way STOP Controls.
LOS for two-way STOP controlled intersections are based on the worst approach/movement of the minor street.

AESD Elementary School TIA - City of Atwater

Figure 8

Cumulative Year 2040 No Project - Traffic Volumes, Geometrics and Controls



JLB TRAFFIC ENGINEERING, INC.

516 W. Shaw Ave., Ste. 103, Fresno, CA 93704

PHONE:(559) 570-8991, EMAIL: info@JLBtraffic.com, www.JLBtraffic.com

005-005 - 08/05/20 - CS

Cumulative Year 2040 plus Project Traffic Conditions

Traffic Signal Warrants

Peak hour traffic signal warrants, as appropriate, were prepared for the unsignalized intersections in the Cumulative Year 2040 plus Project Traffic Conditions scenario. These warrants are found in Appendix J. These warrants were prepared pursuant to the CA MUTCD guidelines for the preparation of traffic signal warrants. Under this scenario, the intersection of Bridgewater Street and Juniper Avenue is projected to satisfy the peak hour traffic signal warrant during both peak periods. Based on the traffic signal warrants and engineering judgement, signalization of this intersection is recommended.

Results of Cumulative Year 2040 plus Project Level of Service Analysis

The Cumulative Year 2040 plus Project Traffic Conditions scenario assumes that the existing roadway geometrics and traffic controls will remain in place. Figure 9 illustrates the Cumulative Year 2040 plus Project turning movement volumes, intersection geometrics and traffic controls. LOS worksheets for the Cumulative Year 2040 plus Project Traffic Conditions scenario are provided in Appendix I. Table VII presents a summary of the Cumulative Year 2040 plus Project peak hour LOS at the study intersections.

Under this scenario, all study intersections are projected to exceed their LOS threshold during both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.

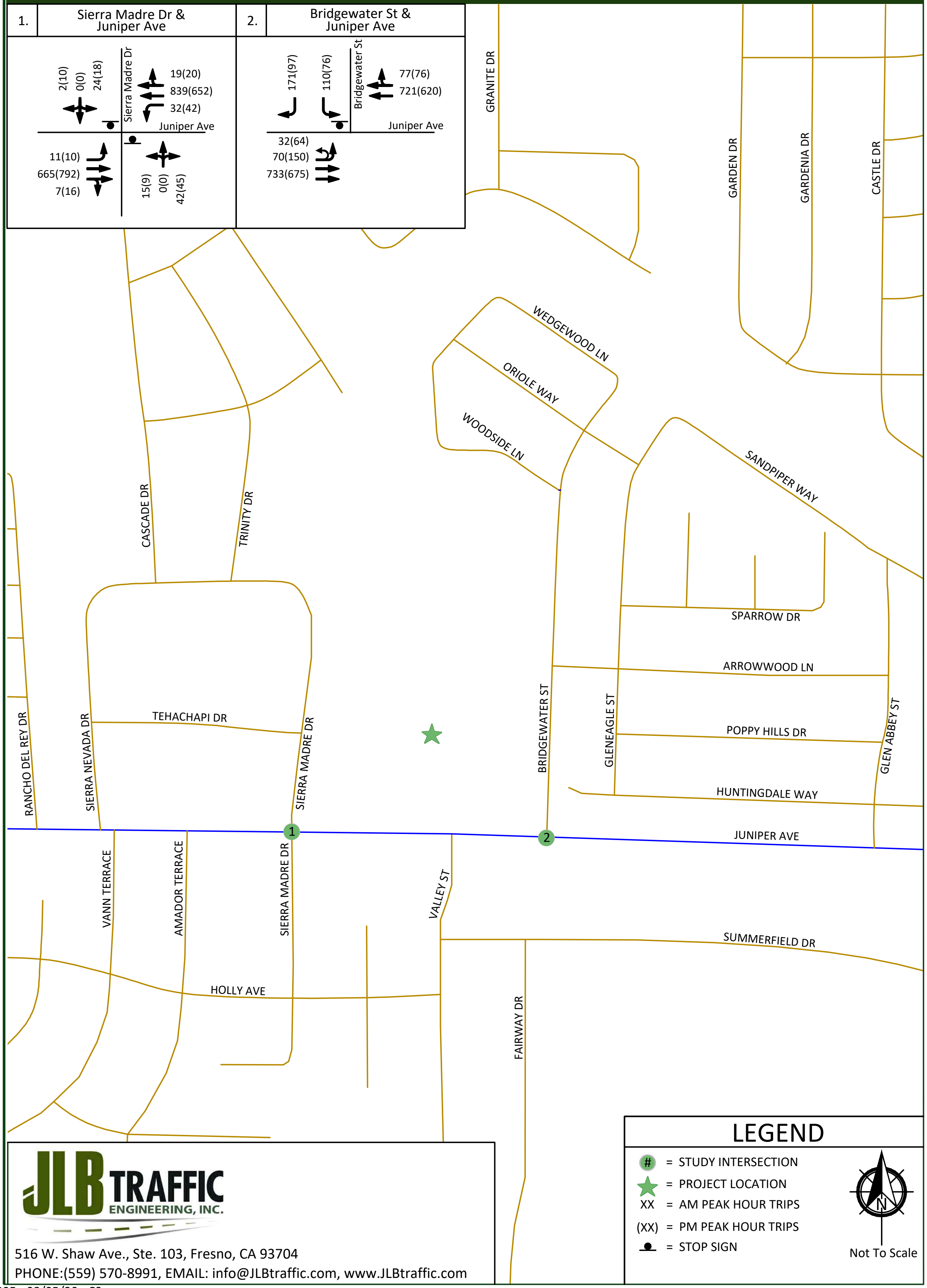
- Sierra Madre Drive / Juniper Avenue
  - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
- Bridgewater Street / Juniper Avenue
  - Signalize the intersection with protective left-turn phasing in all directions.

Table VII: Cumulative Year 2040 plus Project Intersection LOS Results

ID	Intersection	Intersection Control	AM (7-9) Peak Hour		PM (2-4) Peak Hour	
			Average Delay (sec/veh)	LOS	Average Delay (sec/veh)	LOS
1	Sierra Madre Drive / Juniper Avenue	Two-Way Stop	**72.6**	**F**	**37.6**	**E**
		Two-Way Stop (Improved)	12.1	B	12.4	B
2	Bridgewater Street / Juniper Avenue	One-Way Stop	**>120.0**	**F**	**>120.0**	**F**
		Signalized (Improved)	11.6	B	11.8	B

Note: LOS = Level of Service based on average delay on signalized intersections and All-Way STOP Controls.
LOS for two-way STOP controlled intersections are based on the worst approach/movement of the minor street.

AESD Elementary School TIA - City of Atwater
Figure 9
Cumulative Year 2040 plus Project - Traffic Volumes, Geometrics and Controls



005-005 - 08/05/20 - CS

Queuing Analysis

Table VIII provides a queue length summary for left-turn and right-turn lanes at the study intersections under all study scenarios. The queuing analyses for the study intersections are contained in the LOS worksheets for the respective scenarios. Appendix D contains the methodologies used to evaluate these intersections. Queuing analyses were completed using Sim Traffic output information. Synchro provides both 50th and 95th percentile maximum queue lengths (in feet). According to the Synchro manual, "the 50th percentile maximum queue is the maximum back of queue on a typical cycle and the 95th percentile queue is the maximum back of queue with 95th percentile volumes." The queues shown on Table VIII are the 95th percentile queue lengths for the respective lane movements.

The Highway Design Manual (HDM) provides guidance for determining deceleration lengths for the left-turn and right-turn lanes based on design speeds. Per the HDM criteria, "tapers for right-turn lanes are usually un-necessary since the main line traffic need not be shifted laterally to provide space for the right-turn lane. If, in some rare instances, a lateral shift was needed, the approach taper would use the same formula as for a left-turn lane." Therefore, a bay taper length pursuant to the Caltrans HDM would need to be added, as necessary, to the recommended storage lengths presented in Table VIII.

The storage capacity for the Cumulative Year 2040 scenarios shall be based on the SimTraffic output files and engineering judgement. The values in bold presented in Table VIII are the projected queue lengths that will likely need to be accommodated by the Cumulative Year 2040 scenario. At the remaining approaches, the existing storage capacity will be sufficient to accommodate the maximum queue.

- Bridgewater Street / Juniper Avenue
  - Consider increasing the storage capacity of the eastbound left-turn lane to 150 feet.
    - This recommendation directly impacts the adjoining westbound left-turn lane at Valley Street and Juniper Avenue. The storage capacity requirements would require removal of the westbound left-turn lane. So, existing westbound left-turns movements at Valley Street and Juniper Avenue would need to modify their travel patterns to access at Augusta Lane or Sierra Madre Drive for example. Altogether, the impact of eliminating the existing westbound left-turn lane at Valley Street and Juniper Avenue is considered less than significant as the minor increase in travel will be offset by an improvement in traffic safety and operations.

Table VIII: Queuing Analysis

ID	Intersection	Existing Queue Storage Length (ft.)		Existing		Existing plus Project		Near Term plus Project		Cumulative Year 2040 No Project		Cumulative Year 2040 plus Project	
				AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	Sierra Madre Drive / Juniper Avenue	EB Left	60	16	13	21	17	28	9	17	0	21	21
		EB Thru	>500	0	10	0	10	0	0	0	14	0	0
		EB Thru-Right	>500	0	0	0	9	0	10	0	14	0	14
		WB Left	80	9	9	10	14	17	16	25	40	40	43
		WB Thru	>500	0	0	0	10	0	9	0	13	0	10
		WB Thru-Right	>500	0	9	0	10	0	0	0	0	0	27
		NB Left-Thru-Right	>500	42	36	43	42	*	*	*	*	*	*
		NB Right	*	*	*	*	*	40	41	50	48	50	54
		SB Left-Thru-Right	>500	40	34	42	39	*	*	*	*	*	*
		SB Right	*	*	*	*	*	10	29	0	27	21	28
2	Bridgewater Street / Juniper Avenue	EB U-Left	75	49	60	51	70	49	61	59	104	100	**142**
		EB Thru	>500	0	0	0	0	0	0	99	72	91	111
		EB Thru	>500	0	0	0	0	0	0	113	94	123	108
		WB Thru	>500	0	0	0	0	0	0	112	140	199	132
		WB Thru-Right	>500	0	17	0	7	8	10	130	144	208	138
		SB Left	150	47	32	69	44	78	48	75	84	109	81
		SB Right	>500	59	49	82	57	88	53	78	61	94	68

Note: * = Does not exist or is not projected to exist

Project's Pro-Rata Fair Share of Future Transportation Improvements

The Project's fair share percentage impact to study intersections projected to fall below their LOS threshold and which are not covered by an existing impact fee program is provided in Table IX. The Project's fair share percentage impacts were calculated pursuant to the Caltrans Guide for the Preparation of Traffic Impact Studies. The Project's pro-rata fair shares were calculated utilizing the Existing volumes, Project Only Trips and Cumulative Year 2040 plus Project volumes. Figure 2 illustrates the Existing traffic volumes, Figure 4 illustrates the Project Only Trips, and Figure 9 illustrates the Cumulative Year 2040 plus Project traffic volumes. Since the critical peak period for the study facilities was determined to be during the PM peak, the PM peak volumes are utilized to determine the Project's pro-rata fair share.

It is recommended that the Project contribute its equitable fair share as listed in Table IX for the future improvements necessary to maintain an acceptable LOS. However, fair share contributions should only be made for those facilities or portion thereof currently not funded by the responsible agencies roadway impact fee program(s) or grant funding, as appropriate. For those improvements not presently covered by local and regional roadway impact fee programs or grant funding, it is recommended that the Project contribute its equitable fair share. Payment of the Project's equitable fair share in addition to the local and regional impact fee programs would satisfy the Project's traffic mitigation measures.

This study does not provide construction costs for the recommended mitigation measures; therefore, if the recommended mitigation measures are implemented, it is recommended that the developer work with the City of Atwater to develop the estimated construction cost.

Table IX: Project's Fair Share of Future Roadway Improvements

ID	*Intersection*	*Existing Traffic Volumes (PM Peak)*	*Cumulative Year 2040 plus Project Traffic Volumes (PM Peak)*	*2040 Project Only Trips (PM Peak)*	*Project's Fair Share (%)*
1	Sierra Madre Drive / Juniper Avenue	1,149	1,614	112	24.1
2	Bridgewater Street / Juniper Avenue	1,086	1,758	164	24.4

Note: Project Fair Share = ((Project Only Trips) / (Cumulative Year 2040 + Project Traffic Volumes - Existing Traffic Volumes)) x 100

Conclusions and Recommendations

Conclusions and recommendations regarding the proposed Project are presented below.

Existing Traffic Conditions

- At present, all study intersections operate at an acceptable LOS during both peak periods.

Existing plus Project Traffic Conditions

- The latest Project Site Plan addresses recommendations for the Project exit-only driveway along Juniper Avenue and the northwest corner of Bridgewater and Juniper Avenue.
- A review of the access points to be constructed indicates that they are located at points that minimize traffic operational impacts to the existing roadway network.
- At build-out, the Project is estimated to generate a maximum of 1,134 daily trips, 402 AM peak hour trips and 204 PM peak hour trips.
- the latest Project Site Plan retains the existing Class I Bike Path along its frontage to Juniper Avenue.
- It is recommended that the Project retain existing ADA compliant walkways along its frontages to Bridgewater Street and Juniper Avenue.
- The latest Project Site Plan includes on-site pedestrian features and high-visibility crosswalks across the north leg and west leg of the intersection of Bridgewater Street and Juniper Avenue.
- It is recommended that a) a high-visibility crosswalk with a rapid rectangular flashing beacon system be implemented across the south leg of the intersection of Bridgewater Street and Arrowwood Lane and b) a rapid rectangular flashing beacon be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.
- Upon completion of the Project, the average trip length to Bellevue, Shaffer and Thomas Olaeta will be reduced and the average trip length to the Project will be low due to its location. Additionally, the proposed Project is located near transit services and adequate pedestrian and bicycle facilities.
- In order to promote alternative modes of transportation, it is recommended that AESD work with the City of Atwater to implement a Safe Routes to School plan and seek grant funding to help build walkways and bikeways where they are lacking within a one-mile radius of the proposed Project site.
- It is recommended that the Project prepare a school signage and striping plan in the vicinity of the Project pursuant to the CA MUTCD Part 3 - Markings and Part 7 - Traffic Control for School Areas, that these be reviewed and approved by the City of Atwater, and subsequently implemented prior to opening day of the school component of the Project.
- Under this scenario, all study intersections are projected to operate at an acceptable LOS during both peak periods.

Near Term plus Project Traffic Conditions

- The total trip generation for the Near Term Projects is 9,695 daily trips, 450 AM peak hour trips and 818 PM peak hour trips.
- Under this scenario, the intersection of Sierra Madre Drive and Juniper Avenue is projected to exceed its LOS threshold during the AM peak period only. To improve the LOS at this intersection, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.

Cumulative Year 2040 No Project Traffic Conditions

- Under this scenario, all study intersections are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
  - Bridgewater Street / Juniper Avenue
    - Signalize the intersection with protective left-turn phasing in all directions.

Cumulative Year 2040 plus Project Traffic Conditions

- Under this scenario, all study intersections are projected to exceed their LOS threshold during both peak periods. To improve the LOS at these intersections, it is recommended that the following improvements be implemented.
  - Sierra Madre Drive / Juniper Avenue
    - Modify Sierra Madre Drive full access to Juniper Avenue to limited left-in, right-in and right-out access only. To accomplish this, it is recommended that a raised median island be extended across the intersection along the center of Juniper Avenue for approximately 200 feet in both directions. With the extension of the raised median island, northbound and southbound left-turns would need to be redirected. Northbound left-turning traffic from Sierra Madre Drive could utilize Almador Terrace to access Juniper Avenue and continue westbound. Southbound left-turning traffic from Sierra Madre Drive would be forced to utilize Sierra Nevada Drive to access Juniper Avenue and continue eastbound.
  - Bridgewater Street / Juniper Avenue
    - Signalize the intersection with protective left-turn phasing in all directions.

Queuing Analysis

- It is recommended that the City consider left-turn and right-turn lane storage lengths as indicated in the Queuing Analysis.

Project's Equitable Fair Share

- It is recommended that the Project contribute its equitable Fair Share as presented in Table IX for those future improvements which are not currently covered by an existing impact fee program or grant funds.

Study Participants

JLB Traffic Engineering, Inc. Personnel:

Jose Luis Benavides, PE, TE	Project Manager
Susana Maciel, EIT	Project Engineer
Matthew Arndt, EIT	Engineer I/II
Jove Alcazar, EIT	Engineer I/II
Javier Rios	Engineer I/II
Jesus Garcia	Engineer I/II
Carlos Ayala, EIT	Engineer I/II
Dennis Wynn	Sr. Engineering Technician
Justin Barnett	Engineering Aide
Adrian Benavides	Engineering Aide
Michael McConnell	Engineering Aide
Christian Sanchez	Engineering Aide

Persons Consulted:

Scott Odell	Odell Planning & Research, Inc.
Michael Hayes	City of Atwater
Greg Thompson	City of Atwater
Joe Giulian	County of Merced
Hilda Souza	Caltrans

References

1. Caltrans, *2014 California Manual on Uniform Traffic Control Devices*, November 2014.
2. Caltrans, *Guide for the Preparation of Traffic Impact Studies*, December 2002.
3. City of Atwater, 2020 *General Plan.*
4. Governor's Office of Planning and Research, *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA*, State of California, December 2018.
5. Institute of Transportation Engineers, *Trip Generation Manual,* 10th Edition, Washington D.C., 2017.

Appendix A: Scope of Work

December 19, 2019

Michael Hayes
Consultant City Engineer
City of Atwater
750 Bellevue Road
Atwater, CA 95301

Via E-mail Only: mhayes@atwater.org

Subject: Draft Scope of Work for the Preparation of a Traffic Impact Analysis for the Atwater Elementary School District New Elementary School in the City of Atwater (JLB Project 005-005)

Dear Mr. Hayes,

JLB Traffic Engineering, Inc. (JLB) hereby submits this Draft Scope of Work for the preparation of a Traffic Impact Analysis (TIA) for the Atwater Elementary School District (District) New Elementary School (Project) located at the northwest corner of Bridgewater Street and Juniper Avenue in the City of Atwater. The Project proposes to build an Elementary School estimated to serve up to 600 students. An aerial of the Project site is presented in Exhibit A.

The purpose of the TIA is to evaluate the potential on-site and off-site traffic impacts, identify short-term roadway and circulation needs, determine potential mitigation measures and identify any critical traffic issues that should be addressed in the on-going planning process. In order to evaluate the on-site and off-site traffic impacts of the proposed Project, JLB proposes the following Draft Scope of Work.

Scope of Work

- To arrive at the future forecast volumes, JLB proposes to utilize an average annual growth rate of 1.08 percent to expand existing traffic volumes by 21 years to arrive at the Cumulative Year 2040 traffic volumes. The annual average growth rate of 1.08 is based on a review of the Base Year 2015 and Cumulative Year 2042 Merced CAG models.
- JLB will, as necessary, obtain recent (less than 12 months) or schedule and conduct new traffic counts at the study facility(ies). These counts will include pedestrians and vehicles. These counts will be conducted on typical school schedule and non-inclement weather days as soon as possible. These counts will not take place during weeks with holidays, non-school days, roadway construction, etc.
- JLB will perform a site visit to observe existing traffic conditions, especially during the AM and PM peak hours. Existing roadway conditions including intersection geometrics and traffic controls will be verified.
- JLB will evaluate onsite circulation and provide recommendations as necessary to improve circulation to and within the Project site. Particular attention will be paid to conflicting traffic movements, location of local roadways to major streets, and onsite vehicular ingress and egress routes.

- JLB will conduct an evaluation of the existing and planned circulation network to include, the study intersections, roadway segments as well as any other facilities agreed upon after review of the Scope of Work.
- JLB will prepare California Manual on Uniform Traffic Control Devices (CA MUTCD) Warrant 3 "Peak Hour" for unsignalized study intersections under all scenarios.
- JLB will qualitatively analyze existing and planned transit routes in the vicinity of the Project.
- JLB will qualitatively analyze existing and planned walkways in the vicinity of the Project.
- JLB will qualitatively analyze existing and planned bikeways in the vicinity of the Project.
- JLB will forecast trip distribution based on turn count information, anticipated school boundary, student population densities and the existing circulation network in the vicinity of the Project.
- JLB will evaluate existing and forecast future levels of service (LOS) at the study intersection(s) and/or segment(s). JLB will use HCM 6th Edition or HCM 2000 methodologies, as appropriate, within Synchro software to perform this analysis for the AM and PM peak hours. JLB will identify the cause(s) of poor LOS and propose improvement measures (if any).
- JLB, in consultation with Environmental Consultant and District staff will identify the non-bussing service boundary for elementary school students. Using the no bussing boundary, JLB will conduct a qualitative safe routes to school evaluation. The safe routes to school evaluation will be prepared based on the information provided by the District and aerial surveys to be conducted by JLB. Based on the above information, JLB will provide suggested Safe Routes to School recommendations.
- JLB will prepare the Project's equitable fair share of the mitigation measures (if any).

Study Scenarios:

1. Existing Traffic Conditions with proposed improvement measures (if any);
2. Existing plus Project Traffic Conditions with proposed improvement measures (if any);
3. Near Term plus Project Traffic Conditions with proposed mitigation measures (if any);
4. Cumulative Year 2040 No Project Traffic Conditions with proposed improvement measures (if any);
5. Cumulative Year 2040 plus Project Traffic Conditions with propose mitigation measures (if any).

Weekday peak hours to be analyzed (Tuesday through Thursday only):

1. 7 - 9 AM peak hour
2. 2 - 4 PM peak hour

Study Intersections:

1. Sierra Madre Drive / Juniper Avenue
2. Bridgewater Street / Juniper Avenue

Queuing analysis is included in the proposed scope of work for the study intersections listed above under all study scenarios. This analysis will be utilized to recommend minimum storage lengths for left-turn and right-turn lanes at all study intersections.

Study Segments:

1. None

Project Only Trip Assignment to the following State Facilities:

1. None

Project Trip Generation

Trip generation rates for the proposed Project were obtained from the 10th Edition of the Trip Generation Manual published by the Institute of Transportation Engineers (ITE). Table I presents the trip generation for the proposed Project with trip generation rates for an Elementary School. At buildout, the proposed Project is estimated to generate a maximum of 1,134 daily trips, 402 AM peak hour trips and 102 PM peak hour driveway trips.

Table I: Project Trip Generation

Land Use (ITE Code)	Size	Unit	Daily		AM (7-9) Peak Hour						PM (2-4) Peak Hour					
			Rate	Total	Trip Rate	In %	Out %	In	Out	Total	Trip Rate	In %	Out %	In	Out	Total
Elementary School (520)	600	students	1.89	1,134	0.67	54	46	217	185	402	0.17	48	52	49	53	102
Total Driveway Trips				**1,134**				**217**	**185**	**402**				**49**	**53**	**102**

Near Term Projects to be Included

Based on our local knowledge of the study area, JLB proposes to include near term projects in the vicinity of the proposed Project under the Near Term plus Project scenario. The Near Term projects proposed to be included in the Near Term scenario are:

Project Name	General Location
1. Commercial Development	NEC Buhach Road and One Avenue
2. Commercial Development	NWC & SWC of Buhach Road and Juniper Avenue

Other Near Term Projects the City, County or Caltrans has knowledge and for which it is anticipated that said project(s) is/are projected to be whole or partially built by the Near Term Project Year 2025. City, County and Caltrans as appropriate would provide JLB with project details such as a project description, location, proposed land uses with breakdowns and type of residential units and amount of square footages for non-residential uses.

The Scope of Work is based on our understanding of this Project and our experience with similar TIAs. We kindly ask that responsible agencies submit comments to the Scope of Work by January 3, 2019. If you have any questions or require additional information, please contact me by phone at (559) 317-6243 or by email at marndt@JLBtraffic.com.

Sincerely,

Matthew Arndt, EIT
Engineer I/II

cc: Greg Thompson, City of Atwater
Joe Giulian, County of Merced
Hilda Sousa, Caltrans District 10
Jose Benavides, JLB Traffic Engineering, Inc.

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Exhibt A – Project Site

Matt Arndt

From: Michael Hayes <mhayes@atwater.org>
Sent: Wednesday, January 29, 2020 4:17 PM
To: Matt Arndt
Cc: Mark Pereida; Greg Thompson
Subject: RE: AESD New Elem School: Draft Scope of Work

Hi Matt,

The City has the following comments on your letter of December 19, 2019, Subject: Draft Scope of Work for the Preparation of a Traffic Impact Analysis for the Atwater Elementary School District New Elementary School in the City of Atwater (JLB Project 005-005), 4 pages:

1. The AESD and their consultants have not yet made a site plan available for review. Review of the proposed site plan or alternatives may result in additional comments.
2. All vehicular circulation and/or waiting/standing for drop-off, pick-up, and parking should take place outside the public rights-of-way of any adjoining streets.
3. If preconstruction CAMUTCD warrants are not met for the intersection of Juniper and Bridgewater, then following construction and occupancy of the full student body of the proposed school site, this intersection should be evaluated for the installation of pedestrian-activated crossing treatments such as RRFB, HAWK, or similar.
4. If the anticipated school boundary changes significantly with regard to major streets or areas of higher/lower student population density after conducting traffic studies or preparing analyses, then the studies or analyses should be updated accordingly.
5. Construction is currently underway at the intersection of Juniper and Buhach, adjacent to Buhach Colony High School. The City has observed that this construction has reduced traffic volumes along Juniper and Buhach, possibly affecting the study area. Adjustments should be estimated and incorporated into any studies.

Please let me know if you have any questions.

Thank you.

Respectfully,

Michael Hayes, PE
Contract City Engineer
City of Atwater

Note: Office hours at City Hall are Tuesday and Wednesday only

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From: Matt Arndt
Sent: Wednesday, January 22, 2020 9:17 AM
To: Mark Pereida <mpereida@atwater.org>
Cc: Michael Hayes <mhayes@atwater.org>
Subject: RE: AESD New Elem School: Draft Scope of Work

Hello Mark,

If you could give me an ETA on these comments it would be much appreciated. Thanks.

Sincerely,

Matthew Arndt

Traffic Engineering, Transportation Planning and Parking Solutions
Certified Disadvantaged Business Enterprise (DBE) and Small Business Enterprise (SBE)

516 W. Shaw Ave., Ste. 103
Fresno, CA 93704
Office: (559) 570-8991
Direct: (559) 317-6243
www.JLBtraffic.com

From: Michael Hayes <mhayes@atwater.org>
Sent: Tuesday, January 21, 2020 1:30 PM
To: Matt Arndt <marndt@jlbtraffic.com>
Cc: Mark Pereida <mpereida@atwater.org>; Greg Thompson <gthompson@atwater.org>
Subject: RE: AESD New Elem School: Draft Scope of Work

Hi Matthew,

Because JLB is the City's on-call Traffic Engineer but also prepared this document for the AESD, we have not had enough time to adequately review the Draft Scope of Work.

I have copied Mark Pereida, who is the City's General Services Manager on this reply email; please include him in all future correspondence. Mark is not in the office today; however, we hope to review the Draft SOW with him and provide comments, if any, soon.

Thank you.

Respectfully,

Michael

Michael Hayes, PE
Contract City Engineer
City of Atwater

Note: Office hours at City Hall are Tuesday and Wednesday only

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From: Matt Arndt <marndt@jlbtraffic.com>
Sent: Friday, January 17, 2020 5:15 PM
To: Michael Hayes <mhayes@atwater.org>; Joe.Giulian@countyofmerced.com; Hilda.Sousa@dot.ca.gov; Greg Thompson <gthompson@atwater.org>

Cc: Jose Benavides <jbenavides@jlbtraffic.com>; Susana Maciel <smaciel@jlbtraffic.com>
Subject: RE: AESD New Elem School: Draft Scope of Work

Hello,

As of today we have received no comments on this Draft Scope of Work. We would like to assume everyone is satisfied by the Draft Scope of Work; however, we want to ensure that is the case. If you are preparing comments on this please let me know along with an estimated date we can expect to receive them. If you have no problems with this Draft Scope of Work please let me know it is acceptable to you. Look forward to hearing from you all. Thanks, have a good day.

Sincerely,

Matthew Arndt, EIT

Traffic Engineering, Transportation Planning and Parking Solutions
Certified Disadvantaged Business Enterprise (DBE) and Small Business Enterprise (SBE)

516 W. Shaw Ave., Ste. 103
Fresno, CA 93704
Office: (559) 570-8991
Direct: (559) 317-6243
www.JLBtraffic.com

From: Matt Arndt
Sent: Thursday, December 19, 2019 5:07 PM
To: 'mhayes@atwater.org' <mhayes@atwater.org>
Cc: Jose Benavides <jbenavides@jlbtraffic.com>; Susana Maciel <smaciel@jlbtraffic.com>; 'Joe.Giulian@countyofmerced.com' <Joe.Giulian@countyofmerced.com>; 'Hilda.Sousa@dot.ca.gov' <Hilda.Sousa@dot.ca.gov>; 'gthompson@atwater.org' <gthompson@atwater.org>
Subject: AESD New Elem School: Draft Scope of Work

Hello,

Attached is a Draft Scope of Work for the AESD New Elementary School located on the northwest corner of Bridgewater Street and Juniper Avenue in the City of Atwater. Additionally we are copying Caltrans and the County of Merced as responsible agencies for them to provide input to the Scope of Work.
In the absence of comments to the proposed TIA Scope of Work from the responsible agencies by January 17, 2020, it will be assumed that the above scope of work is acceptable to the responsible agency.
Also, if there is anyone else from the City of Atwater that should be notified or copied in this, please let me know. Thank you, have a nice rest of your day.

Sincerely,

Matthew Arndt, EIT

Appendix B: Traffic Counts

Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:
JLB Traffic Engineering, Inc.
1300 E. Shaw Ave, Suite 103
Fresno, CA

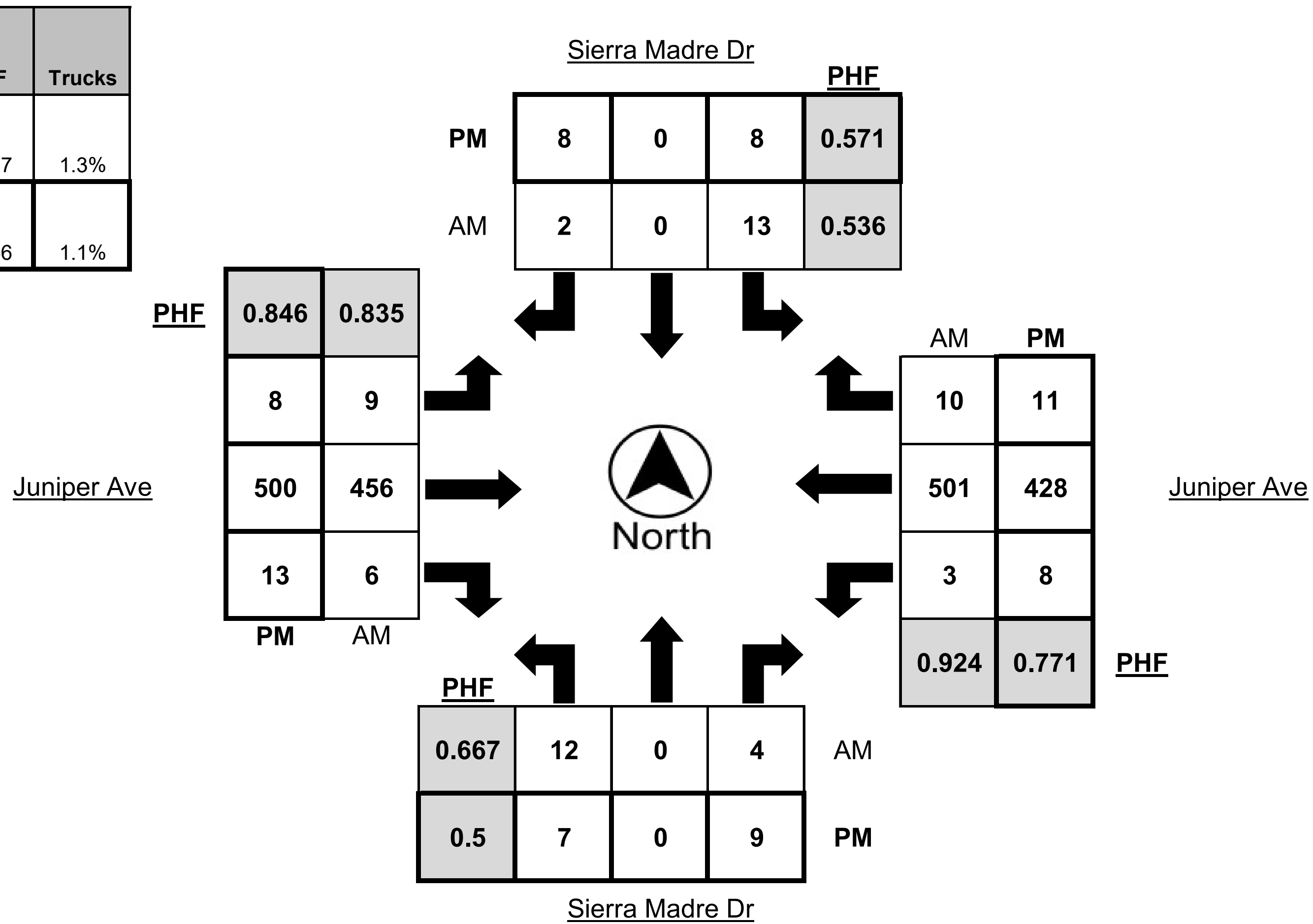
LOCATION Juniper Ave @ Sierra Madre Dr
LATITUDE 37.3498
COUNTY Merced
LONGITUDE -120.5889
COLLECTION DATE Tuesday, January 14, 2020
WEATHER Clear

	Northbound				Southbound				Eastbound				Westbound			
Time	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:00 AM - 7:15 AM	5	0	1	0	0	0	1	0	0	66	2	0	0	94	0	0
7:15 AM - 7:30 AM	3	0	1	0	0	0	0	0	0	108	2	1	2	112	1	1
7:30 AM - 7:45 AM	3	0	0	1	5	0	2	0	1	138	2	2	0	117	5	2
7:45 AM - 8:00 AM	3	0	3	0	4	0	0	0	4	123	2	1	0	138	0	1
8:00 AM - 8:15 AM	3	0	0	0	4	0	0	0	4	87	0	0	1	134	4	4
8:15 AM - 8:30 AM	2	0	0	0	4	0	1	0	4	88	2	3	1	79	3	3
8:30 AM - 8:45 AM	1	0	1	0	3	0	2	1	2	97	2	2	0	49	1	2
8:45 AM - 9:00 AM	0	0	1	0	0	0	1	0	2	50	0	1	0	33	3	1
TOTAL	**20**	**0**	**7**	**1**	**20**	**0**	**7**	**1**	**17**	**757**	**12**	**10**	**4**	**756**	**17**	**14**

	Northbound				Southbound				Eastbound				Westbound			
Time	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
2:00 PM - 2:15 PM	1	1	0	1	1	0	0	0	4	52	2	0	1	62	2	0
2:15 PM - 2:30 PM	3	0	1	1	2	0	2	0	5	60	3	2	1	89	5	0
2:30 PM - 2:45 PM	2	0	0	0	1	0	2	0	2	125	1	2	1	92	3	2
2:45 PM - 3:00 PM	2	0	6	0	2	0	5	0	2	124	6	2	2	139	4	1
3:00 PM - 3:15 PM	3	0	1	0	0	0	0	0	3	148	3	0	3	114	3	1
3:15 PM - 3:30 PM	0	0	2	1	5	0	1	0	1	103	3	1	2	83	1	1
3:30 PM - 3:45 PM	1	0	0	0	1	0	0	0	3	103	3	1	0	97	2	4
3:45 PM - 4:00 PM	0	0	2	0	1	0	1	0	3	94	2	1	1	99	3	0
4:00 PM - 4:15 PM	5	0	1	0	5	0	0	0	5	99	1	0	2	97	5	0
4:15 PM - 4:30 PM	2	0	0	0	2	0	1	0	7	100	1	1	1	106	1	0
4:30 PM - 4:45 PM	4	0	0	0	1	0	0	0	2	96	3	1	3	91	2	1
4:45 PM - 5:00 PM	1	0	1	0	1	0	0	0	0	94	2	2	1	110	2	2
5:00 PM - 5:15 PM	2	0	2	0	2	0	1	0	3	114	2	0	0	99	7	0
5:15 PM - 5:30 PM	2	0	2	0	0	0	1	0	1	92	2	0	5	126	0	0
5:30 PM - 5:45 PM	1	0	0	0	1	0	0	0	2	96	2	0	2	122	1	1
5:45 PM - 6:00 PM	0	0	2	0	1	1	1	0	1	80	3	0	3	80	8	1
TOTAL	**29**	**1**	**20**	**3**	**26**	**1**	**15**	**0**	**44**	**1580**	**39**	**13**	**28**	**1606**	**49**	**14**

	Northbound				Southbound				Eastbound				Westbound			
PEAK HOUR	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks	Left	Thru	Right	Trucks
7:15 AM - 8:15 AM	12	0	4	1	13	0	2	0	9	456	6	4	3	501	10	8
2:30 PM - 3:30 PM	7	0	9	1	8	0	8	0	8	500	13	5	8	428	11	5

	PHF	Trucks
AM	0.917	1.3%
PM	0.856	1.1%



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Turning Movement Report

Prepared For:
JLB Traffic Engineering, Inc.
1300 E. Shaw Ave, Suite 103
Fresno, CA

LOCATION Juniper Ave @ Sierra Madre Dr | **LATITUDE** 37.3498

COUNTY Merced | **LONGITUDE** -120.5889

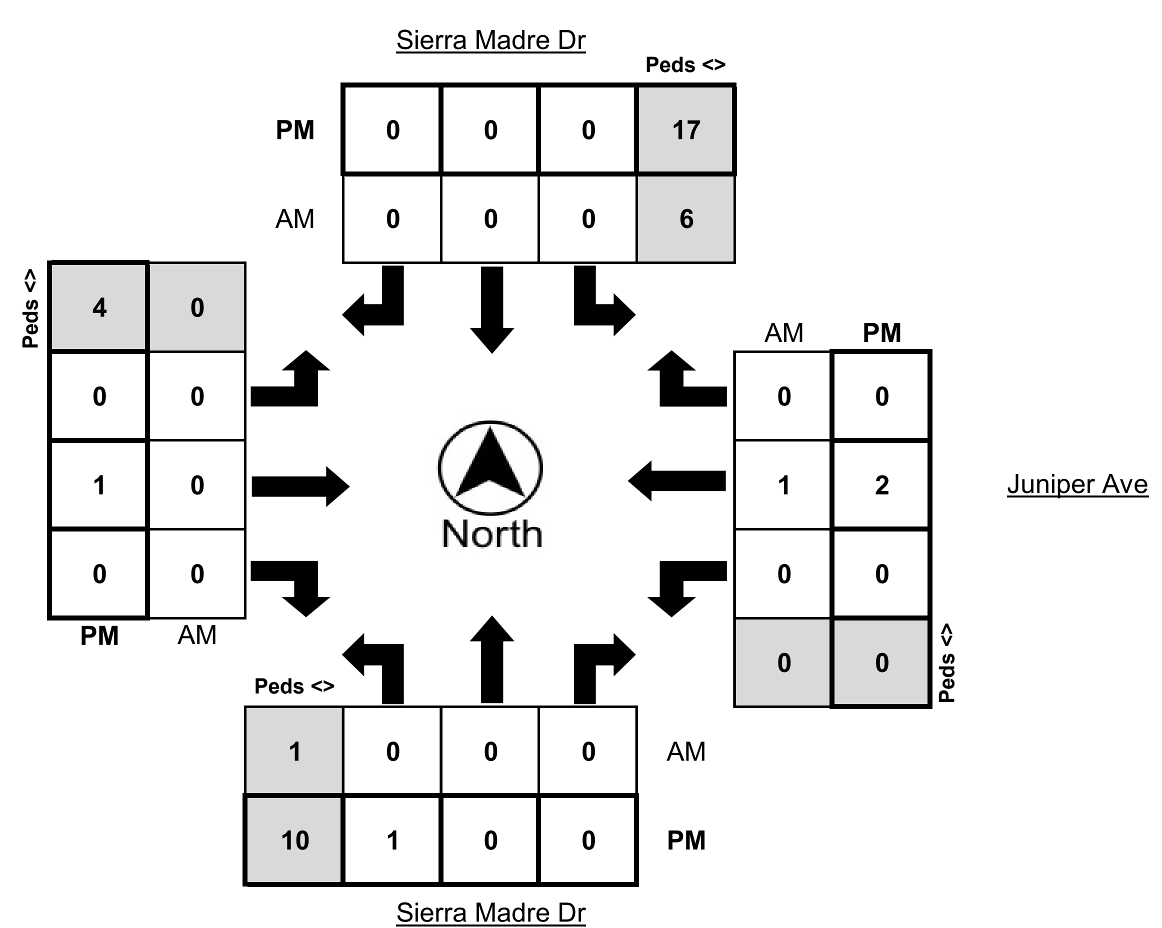
COLLECTION DATE Tuesday, January 14, 2020 | **WEATHER** Clear

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
7:30 AM - 7:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**11**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
2:00 PM - 2:15 PM	0	0	0	23	0	0	0	3	0	0	0	0	0	0	0	3
2:15 PM - 2:30 PM	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	1
2:30 PM - 2:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
2:45 PM - 3:00 PM	0	0	0	4	0	0	0	1	0	0	0	0	0	1	0	0
3:00 PM - 3:15 PM	0	0	0	8	0	0	0	4	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	1	0	0	4	0	0	0	5	0	1	0	0	0	1	0	2
3:30 PM - 3:45 PM	0	0	0	6	0	0	0	0	0	0	1	0	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4:00 PM - 4:15 PM	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0
4:15 PM - 4:30 PM	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	1
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
5:00 PM - 5:15 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
5:15 PM - 5:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**1**	**0**	**0**	**73**	**0**	**0**	**0**	**16**	**0**	**1**	**1**	**0**	**0**	**3**	**0**	**11**

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
PEAK HOUR	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:15 AM - 8:15 AM	0	0	0	6	0	0	0	1	0	0	0	0	0	1	0	0
2:30 PM - 3:30 PM	1	0	0	17	0	0	0	10	0	1	0	0	0	2	0	4

	Bikes	Peds
AM Peak Total	1	7
PM Peak Total	4	31



Metro Traffic Data Inc.
310 N. Irwin Street - Suite 20
Hanford, CA 93230

800-975-6938 Phone/Fax
www.metrotrafficdata.com

Turning Movement Report

Prepared For:
JLB Traffic Engineering, Inc.
1300 E. Shaw Ave, Suite 103
Fresno, CA

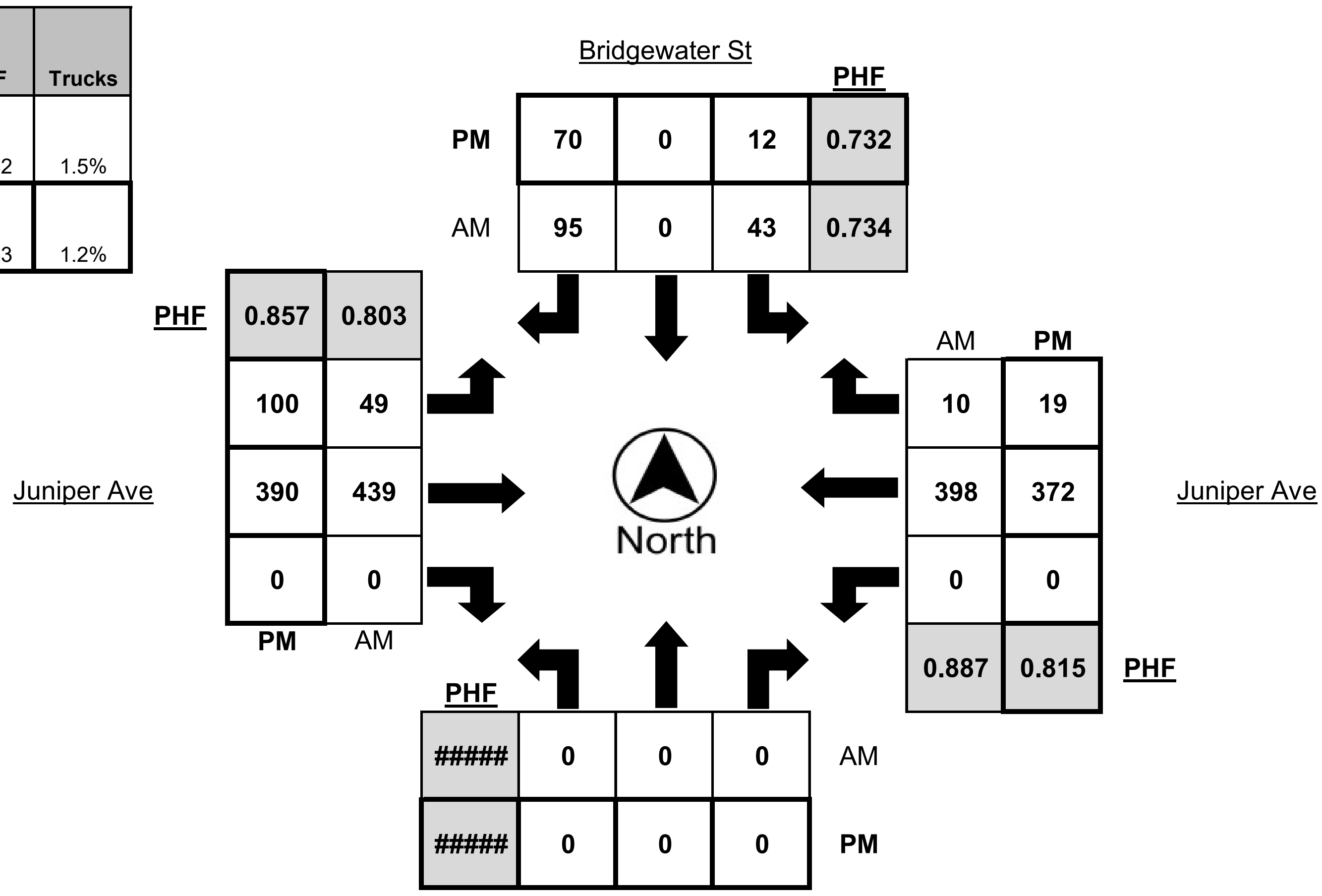
LOCATION	Juniper Ave @ Bridgewater St	**LATITUDE**	37.3497
COUNTY	Merced	**LONGITUDE**	-120.5854
COLLECTION DATE	Tuesday, January 14, 2020	**WEATHER**	Clear

	Northbound				Southbound				Eastbound				Westbound			
Time	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
7:00 AM - 7:15 AM	0	0	0	0	10	0	19	0	7	63	0	0	0	64	5	0
7:15 AM - 7:30 AM	0	0	0	0	10	0	25	0	11	88	0	1	0	87	2	2
7:30 AM - 7:45 AM	0	0	0	0	14	0	33	1	13	139	0	1	0	87	2	3
7:45 AM - 8:00 AM	0	0	0	0	14	0	19	0	15	130	0	1	0	110	5	2
8:00 AM - 8:15 AM	0	0	0	0	5	0	18	0	10	82	0	1	0	114	1	4
8:15 AM - 8:30 AM	0	0	0	0	4	0	21	0	16	66	0	2	0	58	4	2
8:30 AM - 8:45 AM	0	0	0	0	4	0	13	1	19	76	0	4	0	32	1	2
8:45 AM - 9:00 AM	0	0	0	0	5	0	8	0	4	51	0	1	0	27	5	0
TOTAL	**0**	**0**	**0**	**0**	**66**	**0**	**156**	**2**	**95**	**695**	**0**	**11**	**0**	**579**	**25**	**15**

	Northbound				Southbound				Eastbound				Westbound			
Time	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
2:00 PM - 2:15 PM	0	0	0	0	1	0	9	0	14	45	0	0	0	52	6	0
2:15 PM - 2:30 PM	0	0	0	0	2	0	23	0	13	45	0	1	0	63	6	0
2:30 PM - 2:45 PM	0	0	0	0	3	0	19	0	19	100	0	1	0	73	4	3
2:45 PM - 3:00 PM	0	0	0	0	3	0	25	0	15	106	0	1	0	113	4	1
3:00 PM - 3:15 PM	0	0	0	0	3	0	13	0	40	103	0	1	0	114	6	3
3:15 PM - 3:30 PM	0	0	0	0	3	0	13	0	26	81	0	1	0	72	5	1
3:30 PM - 3:45 PM	0	0	0	0	4	0	11	0	24	73	0	2	0	87	4	4
3:45 PM - 4:00 PM	0	0	0	0	1	0	19	0	13	70	0	0	0	83	6	0
4:00 PM - 4:15 PM	0	0	0	0	3	0	12	0	27	75	0	1	0	86	5	0
4:15 PM - 4:30 PM	0	0	0	0	2	0	17	2	23	79	0	1	0	94	3	1
4:30 PM - 4:45 PM	0	0	0	0	7	0	11	0	16	76	0	2	0	82	8	1
4:45 PM - 5:00 PM	0	0	0	0	1	0	13	1	25	74	0	2	0	98	8	1
5:00 PM - 5:15 PM	0	0	0	0	6	0	11	1	21	86	0	1	0	91	5	0
5:15 PM - 5:30 PM	0	0	0	0	5	0	14	0	17	72	0	0	0	114	7	0
5:30 PM - 5:45 PM	0	0	0	0	5	0	19	0	16	68	0	0	0	101	13	1
5:45 PM - 6:00 PM	0	0	0	0	1	0	17	0	20	60	0	0	0	74	4	0
TOTAL	**0**	**0**	**0**	**0**	**50**	**0**	**246**	**4**	**329**	**1213**	**0**	**14**	**0**	**1397**	**94**	**16**

	Northbound				Southbound				Eastbound				Westbound			
PEAK HOUR	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**	**Left**	**Thru**	**Right**	**Trucks**
7:15 AM - 8:15 AM	0	0	0	0	43	0	95	1	49	439	0	4	0	398	10	11
2:30 PM - 3:30 PM	0	0	0	0	12	0	70	0	100	390	0	4	0	372	19	8

	PHF	Trucks
AM	0.882	1.5%
PM	0.863	1.2%



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Turning Movement Report

Prepared For:
JLB Traffic Engineering, Inc.
1300 E. Shaw Ave, Suite 103
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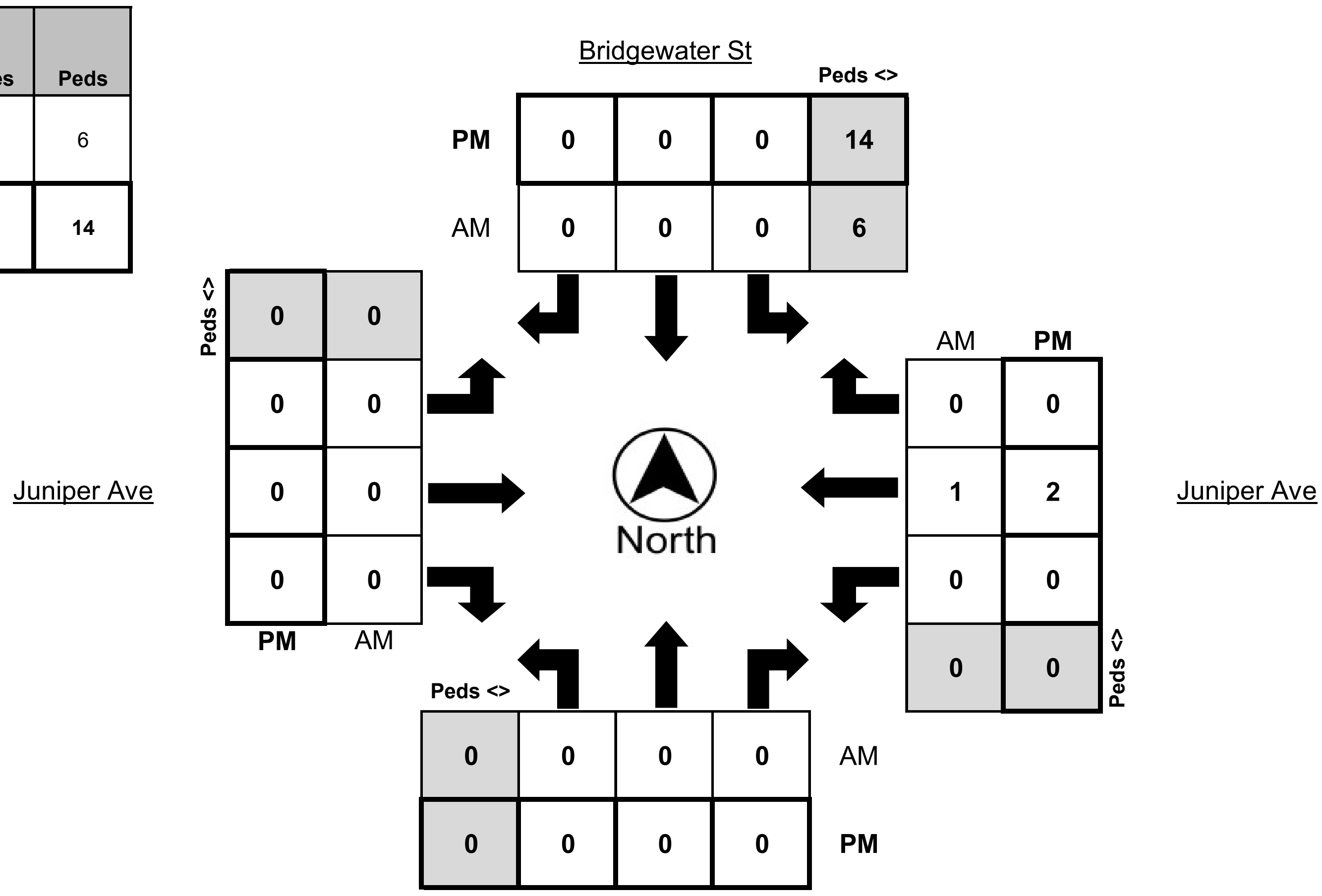
LOCATION Juniper Ave @ Bridgewater St
LATITUDE 37.3497
COUNTY Merced
LONGITUDE -120.5854
COLLECTION DATE Tuesday, January 14, 2020
WEATHER Clear

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:00 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM - 7:30 AM	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
7:30 AM - 7:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM - 8:15 AM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM - 8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM - 8:45 AM	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM - 9:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**

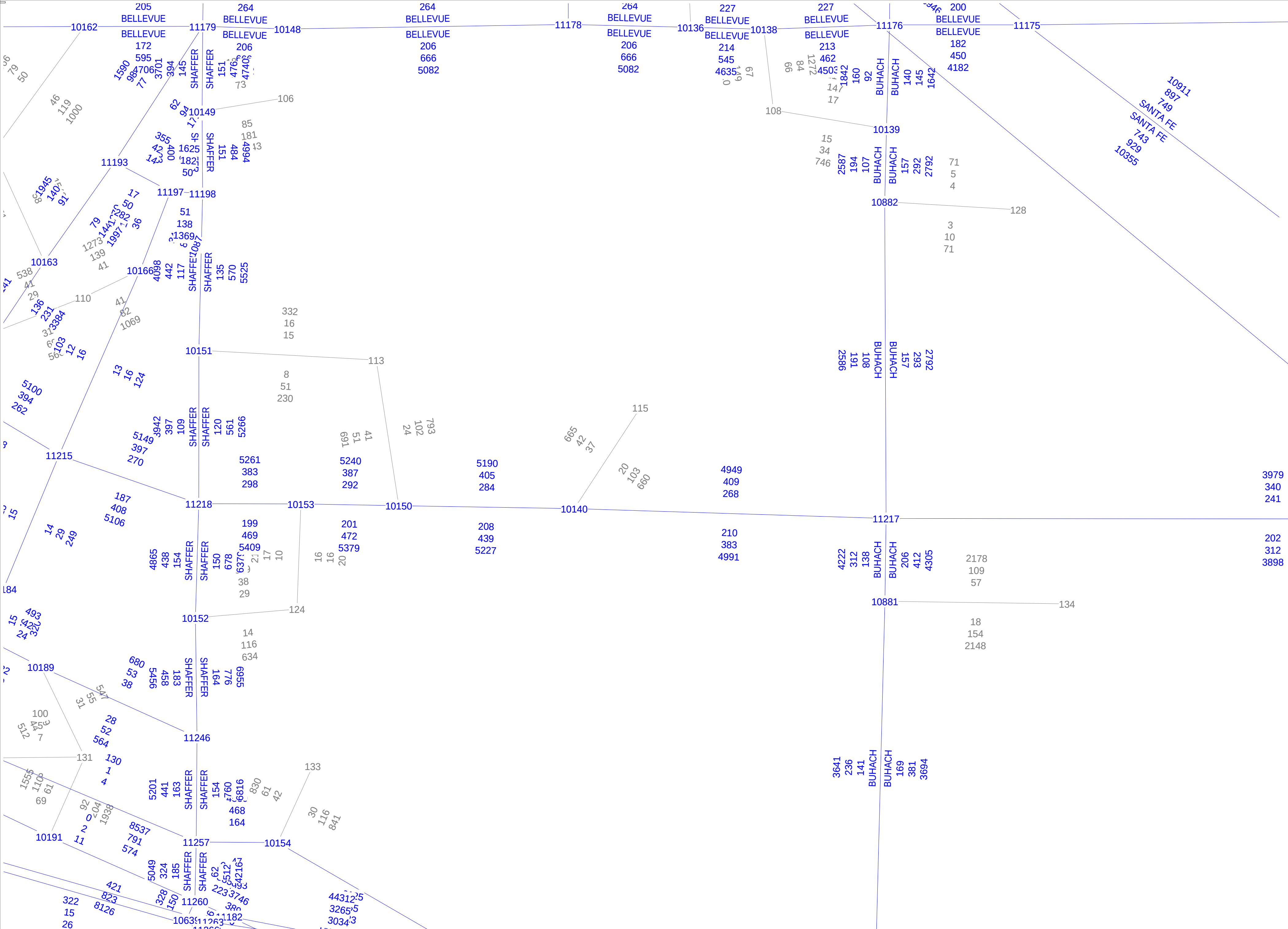
	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
2:00 PM - 2:15 PM	0	0	0	27	0	0	0	0	0	0	0	1	0	0	0	0
2:15 PM - 2:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2:30 PM - 2:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:00 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
3:00 PM - 3:15 PM	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 3:30 PM	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
3:30 PM - 3:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM - 4:15 PM	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM - 4:30 PM	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM - 4:45 PM	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM - 5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
5:00 PM - 5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM - 5:30 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM - 5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM - 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**4**	**0**	**0**

	Northbound Bikes			N.Leg	Southbound Bikes			S.Leg	Eastbound Bikes			E.Leg	Westbound Bikes			W.Leg
PEAK HOUR	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
7:15 AM - 8:15 AM	0	0	0	6	0	0	0	0	0	0	0	0	0	1	0	0
2:30 PM - 3:30 PM	0	0	0	14	0	0	0	0	0	0	0	0	0	2	0	0

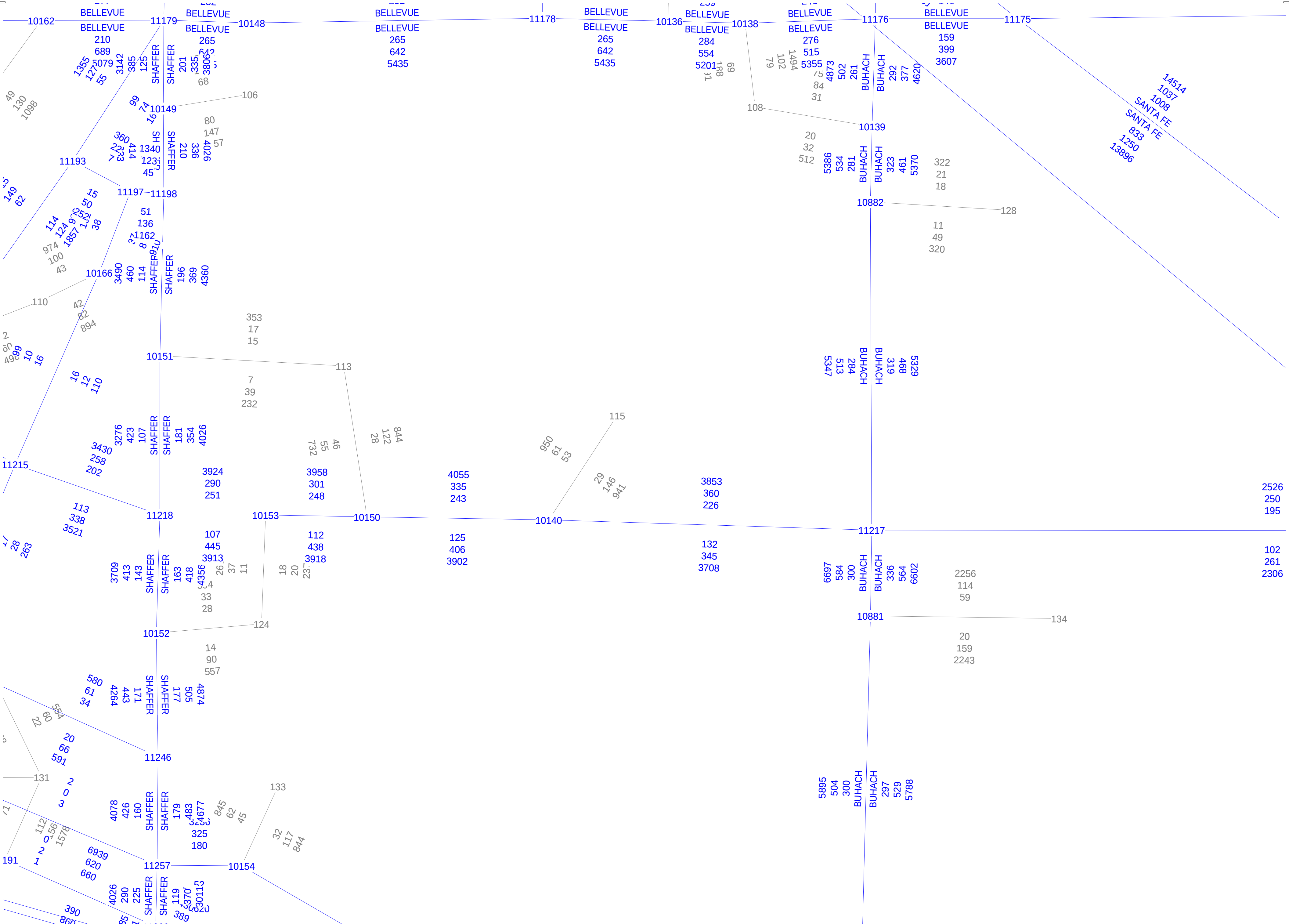
	Bikes	Peds
AM Peak Total	1	6
PM Peak Total	2	14



Appendix C: Traffic Models



Base Year 2015
AM, PM and Daily Volumes



Cumulative Year 2042
AM, PM and Daily Volumes

cube

(Licensed to JLB Traffic Engineering Inc)

Appendix D: Methodology

www.JLBtraffic.com

info@JLBtraffic.com

516 W. Shaw Ave., Ste. 103

Fresno, CA 93704

(559) 570-8991

Levels of Service Methodology

The description and procedures for calculating capacity and level of service (LOS) are found in the Transportation Research Board, Highway Capacity Manual (HCM). The HCM 2010 represents the research on capacity and quality of service for transportation facilities.

Quality of service requires quantitative measures to characterize operational conditions within a traffic stream. Level of service is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience.

Six levels of service are defined for each type of facility that has analysis procedures available. Letters designate each level of service (LOS), from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perception of these conditions. Safety is not included in the measures that establish a LOS.

Urban Streets (Automobile Mode)

The term "urban streets" refers to urban arterials and collectors, including those in downtown areas. Arterial streets are roads that primarily serve longer through trips. However, providing access to abutting commercial and residential land uses is also an important function of arterials. Collector streets provide both land access and traffic circulation within residential, commercial and industrial areas. Their access function is more important than that of arterials, and unlike arterials their operation is not always dominated by traffic signals. Downtown streets are signalized facilities that often resemble arterials. They not only move through traffic but also provide access to local businesses for passenger cars, transit buses, and trucks. Pedestrian conflicts and lane obstructions created by stopping or standing taxicabs, buses, trucks and parking vehicles that cause turbulence in the traffic flow are typical of downtown streets.

Flow Characteristics

The speed of vehicles on urban streets is influenced by three main factors, street environment, interaction among vehicles and traffic control.

The street environment includes the geometric characteristics of the facility, the character of roadside activity, and adjacent land uses. Thus, the environment reflects the number and width of lanes, type of median, driveway/access point density, spacing between signalized intersections, existence of parking, level of pedestrian and bicyclist activity and speed limit.

The interaction among vehicles is determined by traffic density, the proportion of trucks and buses, and turning movements. This interaction affects the operation of vehicles at intersections and, to a lesser extent, between signals.

Traffic controls (including signals and signs) forces a portion of all vehicles to slow or stop. The delays and speed changes caused by traffic control devices reduce vehicle speeds; however, such controls are needed to establish right-of-way.

Levels of Service (automobile Mode)

The average travel speed for through vehicles along an urban street is the determinant of the operating level of service (LOS). The travel speed along a segment, section or entire length of an urban street is dependent on the running speed between signalized intersections and the amount of control delay incurred at signalized intersections.

LOS A describes primarily free-flow operation. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is minimal. Travel speeds exceed 85 of the base free flow speed (FFS).

LOS B describes reasonably unimpeded operation. The ability to maneuver within the traffic stream is only slightly restricted and control delay at the boundary intersections is not significant. The travel speed is between 67 and 85 percent of the base FFS.

LOS C describes stable operations. The ability to maneuver and change lanes in midblock location may be more restricted than at LOS B. Longer queues at the boundary intersections may contribute to lower travel speeds. The travel speed is between 50 and 67 percent of the base FFS.

LOS D indicates a less stable condition in which small increases in flow may cause substantial increases in delay and decreases in travel speed. This operation may be due to adverse signal progression, high volumes, inappropriate signal timing, at the boundary intersections. The travel speed is between 40 and 50 percent of the base FFS.

LOS E is characterized unstable operation and significant delay. Such operations may be due to some combination of adverse progression, high volume, and inappropriate signal timing at the boundary intersections. The travel speed is between 30 and 40 percent of the base FFS.

LOS F is characterized by street flow at extremely low speed. Congestion is likely occurring at the boundary intersections, as indicated by high delay and extensive queuing. The travel speed is 30 percent or less of the base FFS.

Table A-1: Urban Street Levels of Service (Automobile Mode)

Travel Speed as a Percentage of Base Free-Flow Speed (%)	LOS by Critical Volume-to-Capacity Ratio[a]	
	≤1.0	>1.0
>85	A	F
>67 to 85	B	F
>50 to 67	C	F
>40 to 50	D	F
>30 to 40	E	F
≤30	F	F

a = The Critical volume-to-capacity ratio is based on consideration of the through movement-to-capacity ratio at each boundary intersection in the subject direction of travel. The critical volume-to-capacity ratio is the largest ratio of those considered.
Source: Highway Capacity Manual 2010, Exhibit 16-4. Urban Street LOS Criteria (Automobile Mode)

Intersection Levels of Service

One of the more important elements limiting, and often interrupting the flow of traffic on a highway is the intersection. Flow on an interrupted facility is usually dominated by points of fixed operation such as traffic signals, stop and yield signs.

Signalized Intersections – Performance Measures

For signalized intersections the performance measures include automobile volume-to-capacity ratio, automobile delay, queue storage length, ratio of pedestrian delay, pedestrian circulation area, pedestrian perception score, bicycle delay, and bicycle perception score. LOS is also considered a performance measure. For the automobile mode average control delay per vehicle per approach is determined for the peak hour. A weighted average of control delay per vehicle is then determined for the intersection. A LOS designation is given to the weighted average control delay to better describe the level of operation. A description of LOS for signalized intersections is found in Table A-2.

Table A-2: Signalized Intersection Level of Service Description (Automobile Mode)

Level of Service	Description	Average Control Delay (seconds per vehicle)
A	Operations with a control delay of 10 seconds/vehicle or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when volume-to-capacity ratio is and either progression is exceptionally favorable or the cycle length is very short. If it's due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.	≤10
B	Operations with control delay between 10.1 to 20.0 seconds/vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.	>10.0 to 20.0
C	Operations with average control delays between 20.1 to 35.0 seconds/vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.	>20 to 35
D	Operations with control delay between 35.1 to 55.0 seconds/vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop, and i ndividual cycle failures are noticeable.	>35 to 55
E	Operations with control delay between 55.1 to 80.0 seconds/vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.	>55 to 80
F	Operations with unacceptable control delay exceeding 80.0 seconds/vehicle and a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.	>80

Source: Highway Capacity Manual 2010

Unsignalized Intersections

The HCM 2010 procedures use control delay as a measure of effectiveness to determine level of service. Delay is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, i. e., in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Control delay is the increased time of travel for a vehicle approaching and passing through an unsignalized intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection.

All-Way Stop Controlled Intersections

All-way stop controlled intersections is a form of traffic controls in which all approaches to an intersection are required to stop. Similar to signalized intersections, at all-way stop controlled intersections the average control delay per vehicle per approach is determined for the peak hour. A weighted average of control delay per vehicle is then determined for the intersection as a whole. In other words the delay measured for all-way stop controlled intersections is a measure of the average delay for all vehicles passing through the intersection during the peak hour. A LOS designation is given to the weighted average control delay to better describe the level of operation.

Two-Way Stop Controlled Intersections

Two-way stop controlled (TWSC) intersections in which stop signs are used to assign the right-of-way, are the most prevalent type of intersection in the United States. At TWSC intersections the stop-controlled approaches are referred as the minor street approaches and can be either public streets or private driveways. The approaches that are not controlled by stop signs are referred to as the major street approaches.

The capacity of movements subject to delay are determined using the "critical gap" method of capacity analysis. Expected average control delay based on movement volume and movement capacity is calculated. A LOS for TWSC intersection is determined by the computed or measured control delay for each minor movement. LOS is not defined for the intersection as a whole for three main reasons: (a) major-street through vehicles are assumed to experience zero delay; (b) the disproportionate number of major-street through vehicles at the typical TWSC intersection skews the weighted average of all movements, resulting in a very low overall average delay from all vehicles; and (c) the resulting low delay can mask important LOS deficiencies for minor movements. Table A-3 provides a description of LOS at unsignalized intersections.

Table A-3: Unsignalized Intersection Level of Service Description (Automobile Mode)

Control Delay (seconds per vehicle)	**LOS by Volume-to-Capacity Ratio**	
	v/c ≤ 1.0	**v/c > 1.0**
≤10	A	F
>10 to 15	B	F
>15 to 25	C	F
>25 to 35	D	F
>35 to 50	E	F
>50	F	F

Source: HCM 2010 Exhibit 19-1.

Appendix E: Existing Traffic Conditions

Intersection												
Int Delay, s/veh	0.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	529	6	3	581	10	12	0	4	13	0	2
Future Vol, veh/h	9	529	6	3	581	10	12	0	4	13	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	10	575	7	3	632	11	13	0	4	14	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	649	0	0	583	0	0	922	1255	292	958	1253	328
Stage 1	-	-	-	-	-	-	600	600	-	650	650	-
Stage 2	-	-	-	-	-	-	322	655	-	308	603	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	940	-	-	994	-	-	227	172	707	213	172	671
Stage 1	-	-	-	-	-	-	457	491	-	427	466	-
Stage 2	-	-	-	-	-	-	667	463	-	680	489	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	935	-	-	993	-	-	224	168	706	208	168	667
Mov Cap-2 Maneuver	-	-	-	-	-	-	224	168	-	208	168	-
Stage 1	-	-	-	-	-	-	452	485	-	420	462	-
Stage 2	-	-	-	-	-	-	663	459	-	669	483	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0	19.2	21.9
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	270	935	-	-	993	-	-	229
HCM Lane V/C Ratio	0.064	0.01	-	-	0.003	-	-	0.071
HCM Control Delay (s)	19.2	8.9	-	-	8.6	-	-	21.9
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	49	509	462	10	43	95
Future Vol, veh/h	49	509	462	10	43	95
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	1	3	3	1	1	1
Mvmt Flow	56	578	525	11	49	108

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	542	0	-	0	938	274
Stage 1	-	-	-	-	537	-
Stage 2	-	-	-	-	401	-
Critical Hdwy	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	1030	-	-	-	265	727
Stage 1	-	-	-	-	553	-
Stage 2	-	-	-	-	648	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1024	-	-	-	248	723
Mov Cap-2 Maneuver	-	-	-	-	248	-
Stage 1	-	-	-	-	519	-
Stage 2	-	-	-	-	644	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	14.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1024	-	-	-	248	723
HCM Lane V/C Ratio	0.054	-	-	-	0.197	0.149
HCM Control Delay (s)	8.7	-	-	-	23	10.9
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.7	0.5

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	580	13	8	497	11	7	0	9	8	0	8
Future Vol, veh/h	8	580	13	8	497	11	7	0	9	8	0	8
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	9	674	15	9	578	13	8	0	10	9	0	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	608	0	0	699	0	0	1021	1336	355	975	1337	317
Stage 1	-	-	-	-	-	-	710	710	-	620	620	-
Stage 2	-	-	-	-	-	-	311	626	-	355	717	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	973	-	-	900	-	-	192	154	644	207	153	682
Stage 1	-	-	-	-	-	-	393	437	-	445	480	-
Stage 2	-	-	-	-	-	-	677	477	-	638	434	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	957	-	-	891	-	-	184	147	638	197	146	668
Mov Cap-2 Maneuver	-	-	-	-	-	-	184	147	-	197	146	-
Stage 1	-	-	-	-	-	-	386	429	-	434	468	-
Stage 2	-	-	-	-	-	-	658	465	-	622	426	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	17.5	17.6
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	307	957	-	-	891	-	-	304
HCM Lane V/C Ratio	0.061	0.01	-	-	0.01	-	-	0.061
HCM Control Delay (s)	17.5	8.8	-	-	9.1	-	-	17.6
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

Intersection						
Int Delay, s/veh	1.8					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	100	453	432	19	12	70
Future Vol, veh/h	100	453	432	19	12	70
Conflicting Peds, #/hr	14	0	0	14	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	1	3	3	1	1	1
Mvmt Flow	116	527	502	22	14	81

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	538	0	-	0	1023	276
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	496	-
Critical Hdwy	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	1033	-	-	-	233	724
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	580	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1019	-	-	-	201	714
Mov Cap-2 Maneuver	-	-	-	-	201	-
Stage 1	-	-	-	-	489	-
Stage 2	-	-	-	-	572	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	12.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1019	-	-	-	201	714
HCM Lane V/C Ratio	0.114	-	-	-	0.069	0.114
HCM Control Delay (s)	9	-	-	-	24.2	10.7
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.2	0.4

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	28	27	31	31
Average Queue (ft)	3	1	17	15
95th Queue (ft)	16	9	42	40
Link Distance (ft)			862	189
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	60	80		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	SB	SB
Directions Served	L	L	R
Maximum Queue (ft)	72	52	55
Average Queue (ft)	18	23	38
95th Queue (ft)	49	47	59
Link Distance (ft)			293
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	75	150	
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Network Summary

Network wide Queuing Penalty: 0

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	T	L	TR	LTR	LTR
Maximum Queue (ft)	27	31	27	28	31	31
Average Queue (ft)	2	1	1	1	12	11
95th Queue (ft)	13	10	9	9	36	34
Link Distance (ft)		1964		626	862	189
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	60		80			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	73	53	31	54
Average Queue (ft)	25	2	9	26
95th Queue (ft)	60	17	32	49
Link Distance (ft)		2429		293
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		150	
Storage Blk Time (%)	0			
Queuing Penalty (veh)	1			

Network Summary

Network wide Queuing Penalty: 1

Appendix F: Existing plus Project Traffic Conditions

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	538	6	5	700	10	12	0	8	13	0	2
Future Vol, veh/h	9	538	6	5	700	10	12	0	8	13	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	656	7	6	854	12	15	0	10	16	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	872	0	0	664	0	0	1122	1567	333	1228	1564	439
Stage 1	-	-	-	-	-	-	683	683	-	878	878	-
Stage 2	-	-	-	-	-	-	439	884	-	350	686	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	775	-	-	928	-	-	162	111	666	135	112	568
Stage 1	-	-	-	-	-	-	408	450	-	311	366	-
Stage 2	-	-	-	-	-	-	569	364	-	642	448	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	771	-	-	927	-	-	159	108	665	130	109	565
Mov Cap-2 Maneuver	-	-	-	-	-	-	159	108	-	130	109	-
Stage 1	-	-	-	-	-	-	402	443	-	305	362	-
Stage 2	-	-	-	-	-	-	563	360	-	624	441	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	22.6	33.4
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	229	771	-	-	927	-	-	145
HCM Lane V/C Ratio	0.107	0.014	-	-	0.007	-	-	0.126
HCM Control Delay (s)	22.6	9.7	-	-	8.9	-	-	33.4
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.4

Intersection							
Int Delay, s/veh	4.4						

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	32	58	555	578	32	53	148
Future Vol, veh/h	32	58	555	578	32	53	148
Conflicting Peds, #/hr	0	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	39	71	677	705	39	65	180

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	744	750	0	-	0	1290	378
Stage 1	-	-	-	-	-	731	-
Stage 2	-	-	-	-	-	559	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	488	862	-	-	-	156	623
Stage 1	-	-	-	-	-	440	-
Stage 2	-	-	-	-	-	539	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	585	585	-	-	-	125	619
Mov Cap-2 Maneuver	-	-	-	-	-	125	-
Stage 1	-	-	-	-	-	355	-
Stage 2	-	-	-	-	-	536	-

Approach	EB	WB	SB
HCM Control Delay, s	1.8	0	25.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	585	-	-	-	125	619
HCM Lane V/C Ratio	0.188	-	-	-	0.517	0.292
HCM Control Delay (s)	12.6	-	-	-	61.2	13.2
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	0.7	-	-	-	2.4	1.2

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	653	13	9	533	11	7	0	11	8	0	8
Future Vol, veh/h	8	653	13	9	533	11	7	0	11	8	0	8
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	10	777	15	11	635	13	8	0	13	10	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	665	0	0	802	0	0	1159	1502	406	1090	1503	345
Stage 1	-	-	-	-	-	-	815	815	-	681	681	-
Stage 2	-	-	-	-	-	-	344	687	-	409	822	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	927	-	-	824	-	-	152	122	597	171	122	654
Stage 1	-	-	-	-	-	-	340	392	-	409	451	-
Stage 2	-	-	-	-	-	-	647	448	-	593	389	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	912	-	-	816	-	-	145	116	591	161	116	641
Mov Cap-2 Maneuver	-	-	-	-	-	-	145	116	-	161	116	-
Stage 1	-	-	-	-	-	-	333	384	-	398	438	-
Stage 2	-	-	-	-	-	-	626	435	-	574	381	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	19.5	20.1
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	269	912	-	-	816	-	-	257
HCM Lane V/C Ratio	0.08	0.01	-	-	0.013	-	-	0.074
HCM Control Delay (s)	19.5	9	-	-	9.5	-	-	20.1
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.2

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	64	126	494	442	23	21	80
Future Vol, veh/h	64	126	494	442	23	21	80
Conflicting Peds, #/hr	0	14	0	0	14	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	76	150	588	526	27	25	95

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	554	567	0	-	0	1300	291
Stage 1	-	-	-	-	-	554	-
Stage 2	-	-	-	-	-	746	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	644	1008	-	-	-	154	709
Stage 1	-	-	-	-	-	542	-
Stage 2	-	-	-	-	-	432	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	795	795	-	-	-	107	700
Mov Cap-2 Maneuver	-	-	-	-	-	107	-
Stage 1	-	-	-	-	-	383	-
Stage 2	-	-	-	-	-	426	-

Approach	EB	WB	SB
HCM Control Delay, s	3.1	0	18.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	795	-	-	-	107	700
HCM Lane V/C Ratio	0.285	-	-	-	0.234	0.136
HCM Control Delay (s)	11.3	-	-	-	48.6	11
HCM Lane LOS	B	-	-	-	E	B
HCM 95th %tile Q(veh)	1.2	-	-	-	0.8	0.5

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	30	29	31	51
Average Queue (ft)	5	1	19	15
95th Queue (ft)	21	10	43	42
Link Distance (ft)			862	189
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	60	80		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	SB	SB
Directions Served	UL	L	R
Maximum Queue (ft)	54	113	95
Average Queue (ft)	26	36	53
95th Queue (ft)	51	69	82
Link Distance (ft)			293
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	75	150	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Zone Summary

Zone wide Queuing Penalty: 0

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	L	T	TR	L	T	TR	LTR	LTR
Maximum Queue (ft)	30	31	29	29	30	30	32	31
Average Queue (ft)	3	1	1	2	1	1	17	15
95th Queue (ft)	17	10	9	14	10	10	42	39
Link Distance (ft)		1964	1964		255	255	862	189
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	60			80				
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	WB	SB	SB
Directions Served	UL	TR	L	R
Maximum Queue (ft)	79	22	31	56
Average Queue (ft)	38	1	21	33
95th Queue (ft)	70	7	44	57
Link Distance (ft)		2429		293
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		150	
Storage Blk Time (%)	1			
Queuing Penalty (veh)	3			

Zone Summary

Zone wide Queuing Penalty: 3

Appendix G: Near Term plus Project Traffic Conditions

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	546	6	8	707	10	12	0	12	14	0	2
Future Vol, veh/h	9	546	6	8	707	10	12	0	12	14	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	666	7	10	862	12	15	0	15	17	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	880	0	0	674	0	0	1144	1593	338	1249	1590	443
Stage 1	-	-	-	-	-	-	693	693	-	894	894	-
Stage 2	-	-	-	-	-	-	451	900	-	355	696	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	770	-	-	920	-	-	156	107	661	131	108	565
Stage 1	-	-	-	-	-	-	402	445	-	304	360	-
Stage 2	-	-	-	-	-	-	560	358	-	638	444	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	766	-	-	919	-	-	152	104	660	125	105	562
Mov Cap-2 Maneuver	-	-	-	-	-	-	152	104	-	125	105	-
Stage 1	-	-	-	-	-	-	396	438	-	298	354	-
Stage 2	-	-	-	-	-	-	552	352	-	615	437	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	21.5	35.3
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	247	766	-	-	919	-	-	138
HCM Lane V/C Ratio	0.118	0.014	-	-	0.011	-	-	0.141
HCM Control Delay (s)	21.5	9.8	-	-	9	-	-	35.3
HCM Lane LOS	C	A	-	-	A	-	-	E
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.5

Intersection	
Int Delay, s/veh	5

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	32	58	576	595	37	59	148
Future Vol, veh/h	32	58	576	595	37	59	148
Conflicting Peds, #/hr	0	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	39	71	702	726	45	72	180

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	771	777	0	-	0	1326	392
Stage 1	-	-	-	-	-	755	-
Stage 2	-	-	-	-	-	571	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	469	842	-	-	-	148	610
Stage 1	-	-	-	-	-	428	-
Stage 2	-	-	-	-	-	531	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	564	564	-	-	-	118	607
Mov Cap-2 Maneuver	-	-	-	-	-	118	-
Stage 1	-	-	-	-	-	342	-
Stage 2	-	-	-	-	-	528	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	30.8
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	564	-	-	-	118	607
HCM Lane V/C Ratio	0.195	-	-	-	0.61	0.297
HCM Control Delay (s)	12.9	-	-	-	74.5	13.4
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	0.7	-	-	-	3.1	1.2

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	662	13	13	543	12	7	0	15	9	0	8
Future Vol, veh/h	8	662	13	13	543	12	7	0	15	9	0	8
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	10	788	15	15	646	14	8	0	18	11	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	677	0	0	813	0	0	1183	1533	412	1114	1533	351
Stage 1	-	-	-	-	-	-	826	826	-	700	700	-
Stage 2	-	-	-	-	-	-	357	707	-	414	833	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	917	-	-	816	-	-	146	117	592	164	117	648
Stage 1	-	-	-	-	-	-	335	387	-	398	442	-
Stage 2	-	-	-	-	-	-	636	439	-	589	384	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	902	-	-	808	-	-	139	111	586	153	111	635
Mov Cap-2 Maneuver	-	-	-	-	-	-	139	111	-	153	111	-
Stage 1	-	-	-	-	-	-	328	379	-	387	427	-
Stage 2	-	-	-	-	-	-	612	424	-	565	376	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	18.6	21.5
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	290	902	-	-	808	-	-	238
HCM Lane V/C Ratio	0.09	0.011	-	-	0.019	-	-	0.085
HCM Control Delay (s)	18.6	9	-	-	9.5	-	-	21.5
HCM Lane LOS	C	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.3

Intersection	
Int Delay, s/veh	3.7

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	64	126	517	466	31	29	80
Future Vol, veh/h	64	126	517	466	31	29	80
Conflicting Peds, #/hr	0	14	0	0	14	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	76	150	615	555	37	35	95

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	592	606	0	-	0	1348	310
Stage 1	-	-	-	-	-	588	-
Stage 2	-	-	-	-	-	760	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	609	975	-	-	-	143	689
Stage 1	-	-	-	-	-	521	-
Stage 2	-	-	-	-	-	425	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	760	760	-	-	-	98	680
Mov Cap-2 Maneuver	-	-	-	-	-	98	-
Stage 1	-	-	-	-	-	361	-
Stage 2	-	-	-	-	-	419	-

Approach	EB	WB	SB
HCM Control Delay, s	3.2	0	24.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	760	-	-	-	98	680
HCM Lane V/C Ratio	0.298	-	-	-	0.352	0.14
HCM Control Delay (s)	11.7	-	-	-	60.5	11.2
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	1.2	-	-	-	1.4	0.5

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	560	6	8	707	10	0	0	12	0	0	2
Future Vol, veh/h	9	560	6	8	707	10	0	0	12	0	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	683	7	10	862	12	0	0	15	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	880	0	0	691	0	0	-	-	346	-	-	443
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	770	-	-	906	-	-	0	0	653	0	0	565
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	766	-	-	905	-	-	-	-	652	-	-	562
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.1	10.6	11.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	652	766	-	-	905	-	-	562
HCM Lane V/C Ratio	0.022	0.014	-	-	0.011	-	-	0.004
HCM Control Delay (s)	10.6	9.8	-	-	9	-	-	11.4
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	671	13	13	543	12	0	0	15	0	0	8
Future Vol, veh/h	8	671	13	13	543	12	0	0	15	0	0	8
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	10	799	15	15	646	14	0	0	18	0	0	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	677	0	0	824	0	0	-	-	417	-	-	351
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	917	-	-	808	-	-	0	0	587	0	0	648
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	902	-	-	800	-	-	-	-	581	-	-	635
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	11.4	10.8
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	581	902	-	-	800	-	-	635
HCM Lane V/C Ratio	0.031	0.011	-	-	0.019	-	-	0.015
HCM Control Delay (s)	11.4	9	-	-	9.6	-	-	10.8
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	WB	NB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	54	30	53	31
Average Queue (ft)	6	3	13	1
95th Queue (ft)	28	17	40	10
Link Distance (ft)			862	189
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	60	80		
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	WB	SB	SB
Directions Served	UL	TR	L	R
Maximum Queue (ft)	54	23	96	115
Average Queue (ft)	30	1	43	53
95th Queue (ft)	49	8	78	88
Link Distance (ft)		2429		293
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		150	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 0

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	T	R	R
Maximum Queue (ft)	28	30	28	28	31	31
Average Queue (ft)	1	1	3	1	15	7
95th Queue (ft)	9	10	16	9	41	29
Link Distance (ft)		1964		232	862	189
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	60		80			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	WB	SB	SB
Directions Served	UL	TR	L	R
Maximum Queue (ft)	75	22	54	56
Average Queue (ft)	34	1	24	34
95th Queue (ft)	61	10	48	53
Link Distance (ft)		2429		293
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	75		150	
Storage Blk Time (%)	0			
Queuing Penalty (veh)	1			

Zone Summary

Zone wide Queuing Penalty: 1

Appendix H: Cumulative Year 2040 No Project Traffic Conditions

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	656	7	30	720	19	15	0	38	24	0	2
Future Vol, veh/h	11	656	7	30	720	19	15	0	38	24	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	12	713	8	33	783	21	16	0	41	26	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	810	0	0	722	0	0	1200	1618	362	1247	1612	408
Stage 1	-	-	-	-	-	-	742	742	-	866	866	-
Stage 2	-	-	-	-	-	-	458	876	-	381	746	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	818	-	-	883	-	-	142	103	638	131	104	595
Stage 1	-	-	-	-	-	-	376	423	-	316	371	-
Stage 2	-	-	-	-	-	-	555	367	-	616	421	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	813	-	-	882	-	-	136	97	637	117	98	592
Mov Cap-2 Maneuver	-	-	-	-	-	-	136	97	-	117	98	-
Stage 1	-	-	-	-	-	-	370	416	-	310	355	-
Stage 2	-	-	-	-	-	-	532	351	-	568	414	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.4	19.1	42
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	312	813	-	-	882	-	-	125
HCM Lane V/C Ratio	0.185	0.015	-	-	0.037	-	-	0.226
HCM Control Delay (s)	19.1	9.5	-	-	9.2	-	-	42
HCM Lane LOS	C	A	-	-	A	-	-	E
HCM 95th %tile Q(veh)	0.7	0	-	-	0.1	-	-	0.8

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	61	687	605	55	100	118
Future Vol, veh/h	61	687	605	55	100	118
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	3	3	1	1	1
Mvmt Flow	66	747	658	60	109	128

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	724	0	-	0	1200	365
Stage 1	-	-	-	-	694	-
Stage 2	-	-	-	-	506	-
Critical Hdwy	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	881	-	-	-	179	635
Stage 1	-	-	-	-	460	-
Stage 2	-	-	-	-	573	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	876	-	-	-	164	631
Mov Cap-2 Maneuver	-	-	-	-	164	-
Stage 1	-	-	-	-	423	-
Stage 2	-	-	-	-	570	-

Approach	EB		WB		SB
HCM Control Delay, s	0.8		0		35
HCM LOS					E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	876	-	-	-	164	631
HCM Lane V/C Ratio	0.076	-	-	-	0.663	0.203
HCM Control Delay (s)	9.4	-	-	-	62	12.2
HCM Lane LOS	A	-	-	-	F	B
HCM 95th %tile Q(veh)	0.2	-	-	-	3.8	0.8

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	719	16	41	616	20	9	0	43	18	0	10
Future Vol, veh/h	10	719	16	41	616	20	9	0	43	18	0	10
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	782	17	45	670	22	10	0	47	20	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	709	0	0	809	0	0	1252	1622	410	1201	1619	367
Stage 1	-	-	-	-	-	-	823	823	-	788	788	-
Stage 2	-	-	-	-	-	-	429	799	-	413	831	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	893	-	-	819	-	-	130	103	594	142	103	633
Stage 1	-	-	-	-	-	-	336	388	-	353	403	-
Stage 2	-	-	-	-	-	-	577	398	-	590	385	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	879	-	-	811	-	-	120	94	588	122	94	620
Mov Cap-2 Maneuver	-	-	-	-	-	-	120	94	-	122	94	-
Stage 1	-	-	-	-	-	-	329	379	-	343	375	-
Stage 2	-	-	-	-	-	-	533	370	-	536	376	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	17.2	30.6
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	351	879	-	-	811	-	-	171
HCM Lane V/C Ratio	0.161	0.012	-	-	0.055	-	-	0.178
HCM Control Delay (s)	17.2	9.1	-	-	9.7	-	-	30.6
HCM Lane LOS	C	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	0.6	0	-	-	0.2	-	-	0.6

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	124	634	610	72	67	87
Future Vol, veh/h	124	634	610	72	67	87
Conflicting Peds, #/hr	14	0	0	14	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	3	3	1	1	1
Mvmt Flow	135	689	663	78	73	95

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	755	0	-	0	1331	385
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	615	-
Critical Hdwy	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	858	-	-	-	147	616
Stage 1	-	-	-	-	448	-
Stage 2	-	-	-	-	505	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	847	-	-	-	120	608
Mov Cap-2 Maneuver	-	-	-	-	120	-
Stage 1	-	-	-	-	372	-
Stage 2	-	-	-	-	498	-

Approach	EB		WB		SB	
HCM Control Delay, s	1.6		0		38.6	
HCM LOS					E	

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	847	-	-	-	120	608
HCM Lane V/C Ratio	0.159	-	-	-	0.607	0.156
HCM Control Delay (s)	10.1	-	-	-	73.1	12
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	0.6	-	-	-	3.1	0.5

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	680	7	30	720	19	0	0	38	0	0	2
Future Vol, veh/h	11	680	7	30	720	19	0	0	38	0	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	12	739	8	33	783	21	0	0	41	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	810	0	0	748	0	0	-	-	375	-	-	408
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	818	-	-	863	-	-	0	0	625	0	0	595
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	813	-	-	862	-	-	-	-	624	-	-	592
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.4	11.2	11.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	624	813	-	-	862	-	-	592
HCM Lane V/C Ratio	0.066	0.015	-	-	0.038	-	-	0.004
HCM Control Delay (s)	11.2	9.5	-	-	9.3	-	-	11.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1	-	-	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	61	687	605	55	100	118
Future Volume (veh/h)	61	687	605	55	100	118
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.99	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1885	1856	1856	1856	1885	1885
Adj Flow Rate, veh/h	66	747	658	60	109	128
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	3	3	3	1	1
Cap, veh/h	124	2031	1227	112	252	224
Arrive On Green	0.07	0.58	0.38	0.38	0.14	0.14
Sat Flow, veh/h	1795	3618	3357	297	1795	1598
Grp Volume(v), veh/h	66	747	355	363	109	128
Grp Sat Flow(s),veh/h/ln	1795	1763	1763	1799	1795	1598
Q Serve(g_s), s	1.1	3.7	5.1	5.1	1.8	2.4
Cycle Q Clear(g_c), s	1.1	3.7	5.1	5.1	1.8	2.4
Prop In Lane	1.00			0.17	1.00	1.00
Lane Grp Cap(c), veh/h	124	2031	663	676	252	224
V/C Ratio(X)	0.53	0.37	0.54	0.54	0.43	0.57
Avail Cap(c_a), veh/h	716	6271	2202	2248	1667	1483
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	14.4	3.7	7.8	7.8	12.6	12.9
Incr Delay (d2), s/veh	3.5	0.1	0.7	0.7	1.2	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.2	1.1	1.1	0.7	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.9	3.8	8.5	8.5	13.8	15.2
LnGrp LOS	B	A	A	A	B	B
Approach Vol, veh/h		813	718		237	
Approach Delay, s/veh		4.9	8.5		14.5	
Approach LOS		A	A		B	

Timer - Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				23.4		8.7	6.4	17.0
Change Period (Y+Rc), s				4.9		4.2	* 4.2	4.9
Max Green Setting (Gmax), s				57.1		29.8	* 13	40.1
Max Q Clear Time (g_c+I1), s				5.7		4.4	3.1	7.1
Green Ext Time (p_c), s				5.7		0.7	0.1	4.6

Intersection Summary			
HCM 6th Ctrl Delay			7.7
HCM 6th LOS			A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	737	16	41	616	20	0	0	43	0	0	10
Future Vol, veh/h	10	737	16	41	616	20	0	0	43	0	0	10
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	801	17	45	670	22	0	0	47	0	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	709	0	0	828	0	0	-	-	419	-	-	367
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	893	-	-	806	-	-	0	0	586	0	0	633
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	879	-	-	798	-	-	-	-	580	-	-	620
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	11.8	10.9
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	580	879	-	-	798	-	-	620
HCM Lane V/C Ratio	0.081	0.012	-	-	0.056	-	-	0.018
HCM Control Delay (s)	11.8	9.1	-	-	9.8	-	-	10.9
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	124	634	610	72	67	87
Future Volume (veh/h)	124	634	610	72	67	87
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1885	1856	1856	1856	1885	1885
Adj Flow Rate, veh/h	135	689	663	78	73	95
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	3	3	3	1	1
Cap, veh/h	191	2162	1213	142	211	188
Arrive On Green	0.11	0.61	0.38	0.38	0.12	0.12
Sat Flow, veh/h	1795	3618	3263	373	1795	1598
Grp Volume(v), veh/h	135	689	368	373	73	95
Grp Sat Flow(s),veh/h/ln	1795	1763	1763	1780	1795	1598
Q Serve(g_s), s	2.5	3.2	5.5	5.5	1.3	1.9
Cycle Q Clear(g_c), s	2.5	3.2	5.5	5.5	1.3	1.9
Prop In Lane	1.00			0.21	1.00	1.00
Lane Grp Cap(c), veh/h	191	2162	674	681	211	188
V/C Ratio(X)	0.71	0.32	0.55	0.55	0.35	0.51
Avail Cap(c_a), veh/h	415	4269	1508	1523	1382	1230
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	14.6	3.1	8.1	8.1	13.7	14.0
Incr Delay (d2), s/veh	4.8	0.1	0.7	0.7	1.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.1	1.3	1.3	0.5	1.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	19.3	3.2	8.8	8.8	14.7	16.1
LnGrp LOS	B	A	A	A	B	B
Approach Vol, veh/h		824	741		168	
Approach Delay, s/veh		5.9	8.8		15.5	
Approach LOS		A	A		B	

Timer - Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				25.6		8.2	7.8	17.8
Change Period (Y+Rc), s				4.9		4.2	* 4.2	4.9
Max Green Setting (Gmax), s				40.9		26.0	* 7.8	28.9
Max Q Clear Time (g_c+I1), s				5.2		3.9	4.5	7.5
Green Ext Time (p_c), s				5.0		0.5	0.1	4.4

Intersection Summary	
HCM 6th Ctrl Delay	8.1
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	WB	NB
Directions Served	L	L	R
Maximum Queue (ft)	30	30	55
Average Queue (ft)	3	6	26
95th Queue (ft)	17	25	50
Link Distance (ft)			862
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	60	80	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	59	127	121	149	140	94	98
Average Queue (ft)	37	46	62	65	68	48	46
95th Queue (ft)	59	99	113	112	130	75	78
Link Distance (ft)		955	955	2429	2429		293
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	75					150	
Storage Blk Time (%)	0	2					
Queuing Penalty (veh)	1	1					

Network Summary

Network wide Queuing Penalty: 2

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	T	TR	L	T	R	R
Maximum Queue (ft)	31	31	30	41	55	31
Average Queue (ft)	2	2	18	1	29	7
95th Queue (ft)	14	14	40	13	48	27
Link Distance (ft)	1964	1964		955	862	189
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			80			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	127	96	98	186	219	138	77
Average Queue (ft)	59	32	45	81	70	37	33
95th Queue (ft)	104	72	94	140	144	84	61
Link Distance (ft)		955	955	2429	2429		293
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	75					150	
Storage Blk Time (%)	9	1				0	
Queuing Penalty (veh)	30	1				0	

Network Summary

Network wide Queuing Penalty: 30

Appendix I: Cumulative Year 2040 plus Project Traffic Conditions

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	665	7	32	839	19	15	0	42	24	0	2
Future Vol, veh/h	11	665	7	32	839	19	15	0	42	24	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	13	773	8	37	976	22	17	0	49	28	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1004	0	0	782	0	0	1366	1882	392	1480	1875	505
Stage 1	-	-	-	-	-	-	804	804	-	1067	1067	-
Stage 2	-	-	-	-	-	-	562	1078	-	413	808	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	692	-	-	838	-	-	107	71	610	88	72	515
Stage 1	-	-	-	-	-	-	345	396	-	239	299	-
Stage 2	-	-	-	-	-	-	481	295	-	590	394	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	688	-	-	837	-	-	101	66	609	77	67	512
Mov Cap-2 Maneuver	-	-	-	-	-	-	101	66	-	77	67	-
Stage 1	-	-	-	-	-	-	338	388	-	233	284	-
Stage 2	-	-	-	-	-	-	458	280	-	532	386	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	23.3	72.6
HCM LOS			C	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	262	688	-	-	837	-	-	82
HCM Lane V/C Ratio	0.253	0.019	-	-	0.044	-	-	0.369
HCM Control Delay (s)	23.3	10.3	-	-	9.5	-	-	72.6
HCM Lane LOS	C	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	1	0.1	-	-	0.1	-	-	1.4

Intersection	
Int Delay, s/veh	27.5

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	32	70	733	721	77	110	171
Future Vol, veh/h	32	70	733	721	77	110	171
Conflicting Peds, #/hr	0	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	37	81	852	838	90	128	199

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	928	934	0	-	0	1551	470
Stage 1	-	-	-	-	-	889	-
Stage 2	-	-	-	-	-	662	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	372	735	-	-	-	~ 105	543
Stage 1	-	-	-	-	-	364	-
Stage 2	-	-	-	-	-	477	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	460	460	-	-	-	~ 77	540
Mov Cap-2 Maneuver	-	-	-	-	-	~ 77	-
Stage 1	-	-	-	-	-	268	-
Stage 2	-	-	-	-	-	474	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	181.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	460	-	-	-	77	540
HCM Lane V/C Ratio	0.258	-	-	-	1.661	0.368
HCM Control Delay (s)	15.5	-	-	-	$ 439.4	15.5
HCM Lane LOS	C	-	-	-	F	C
HCM 95th %tile Q(veh)	1	-	-	-	10.8	1.7

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	792	16	42	652	20	9	0	45	18	0	10
Future Vol, veh/h	10	792	16	42	652	20	9	0	45	18	0	10
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	880	18	47	724	22	10	0	50	20	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	763	0	0	908	0	0	1381	1778	459	1308	1776	394
Stage 1	-	-	-	-	-	-	921	921	-	846	846	-
Stage 2	-	-	-	-	-	-	460	857	-	462	930	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.52	6.52	6.92	7.52	6.52	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.52	5.52	-	6.52	5.52	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.51	4.01	3.31	3.51	4.01	3.31
Pot Cap-1 Maneuver	852	-	-	752	-	-	104	82	552	118	83	608
Stage 1	-	-	-	-	-	-	293	350	-	325	379	-
Stage 2	-	-	-	-	-	-	553	374	-	552	346	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	838	-	-	745	-	-	95	74	547	99	75	596
Mov Cap-2 Maneuver	-	-	-	-	-	-	95	74	-	99	75	-
Stage 1	-	-	-	-	-	-	286	342	-	316	349	-
Stage 2	-	-	-	-	-	-	507	345	-	495	338	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	19.7	37.6
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	305	838	-	-	745	-	-	141
HCM Lane V/C Ratio	0.197	0.013	-	-	0.063	-	-	0.221
HCM Control Delay (s)	19.7	9.4	-	-	10.2	-	-	37.6
HCM Lane LOS	C	A	-	-	B	-	-	E
HCM 95th %tile Q(veh)	0.7	0	-	-	0.2	-	-	0.8

Intersection	
Int Delay, s/veh	19.1

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Vol, veh/h	64	150	675	620	76	76	97
Future Vol, veh/h	64	150	675	620	76	76	97
Conflicting Peds, #/hr	0	14	0	0	14	0	0
Sign Control	Free	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	-	None	-	None	-	None
Storage Length	-	75	-	-	-	150	0
Veh in Median Storage, #	-	-	0	0	-	0	-
Grade, %	-	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90
Heavy Vehicles, %	1	1	3	3	1	1	1
Mvmt Flow	71	167	750	689	84	84	108

Major/Minor	Major1			Major2		Minor2	
Conflicting Flow All	773	787	0	-	0	1596	401
Stage 1	-	-	-	-	-	745	-
Stage 2	-	-	-	-	-	851	-
Critical Hdwy	6.42	4.12	-	-	-	6.82	6.92
Critical Hdwy Stg 1	-	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	-	5.82	-
Follow-up Hdwy	2.51	2.21	-	-	-	3.51	3.31
Pot Cap-1 Maneuver	467	835	-	-	-	98	602
Stage 1	-	-	-	-	-	433	-
Stage 2	-	-	-	-	-	381	-
Platoon blocked, %			-	-	-		
Mov Cap-1 Maneuver	619	619	-	-	-	~ 59	594
Mov Cap-2 Maneuver	-	-	-	-	-	~ 59	-
Stage 1	-	-	-	-	-	263	-
Stage 2	-	-	-	-	-	376	-

Approach	EB	WB	SB
HCM Control Delay, s	3.5	0	175.6
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	619	-	-	-	59	594
HCM Lane V/C Ratio	0.384	-	-	-	1.431	0.181
HCM Control Delay (s)	14.4	-	-	-	$ 383.8	12.4
HCM Lane LOS	B	-	-	-	F	B
HCM 95th %tile Q(veh)	1.8	-	-	-	7.4	0.7

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	689	7	32	839	19	0	0	42	0	0	2
Future Vol, veh/h	11	689	7	32	839	19	0	0	42	0	0	2
Conflicting Peds, #/hr	6	0	1	1	0	6	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	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	13	801	8	37	976	22	0	0	49	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1004	0	0	810	0	0	-	-	406	-	-	505
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	692	-	-	818	-	-	0	0	597	0	0	515
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	688	-	-	817	-	-	-	-	596	-	-	512
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	11.6	12.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	596	688	-	-	817	-	-	512
HCM Lane V/C Ratio	0.082	0.019	-	-	0.046	-	-	0.005
HCM Control Delay (s)	11.6	10.3	-	-	9.6	-	-	12.1
HCM Lane LOS	B	B	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0.1	-	-	0

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (vph)	32	70	733	721	77	110	171
Future Volume (vph)	32	70	733	721	77	110	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.2	4.9	4.9		4.2	4.2
Lane Util. Factor		1.00	0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00		1.00	1.00
Frt		1.00	1.00	0.99		1.00	0.85
Flt Protected		0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)		1787	3505	3452		1787	1599
Flt Permitted		0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)		1787	3505	3452		1787	1599
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	37	81	852	838	90	128	199
RTOR Reduction (vph)	0	0	0	9	0	0	158
Lane Group Flow (vph)	0	118	852	919	0	128	41
Confl. Peds. (#/hr)					6		
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%	1%
Turn Type	Prot	Prot	NA	NA		Prot	Perm
Protected Phases	7	7	4	8		6	
Permitted Phases							6
Actuated Green, G (s)		7.2	35.1	23.7		11.4	11.4
Effective Green, g (s)		7.2	35.1	23.7		11.4	11.4
Actuated g/C Ratio		0.13	0.63	0.43		0.21	0.21
Clearance Time (s)		4.2	4.9	4.9		4.2	4.2
Vehicle Extension (s)		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		231	2212	1471		366	327
v/s Ratio Prot		c0.07	0.24	c0.27		c0.07	
v/s Ratio Perm							0.03
v/c Ratio		0.51	0.39	0.62		0.35	0.12
Uniform Delay, d1		22.6	5.0	12.5		18.9	18.0
Progression Factor		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2		1.9	0.1	0.8		0.6	0.2
Delay (s)		24.5	5.1	13.3		19.5	18.2
Level of Service		C	A	B		B	B
Approach Delay (s)			7.5	13.3		18.7	
Approach LOS			A	B		B	

Intersection Summary			
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	55.6	Sum of lost time (s)	13.3
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	810	16	42	652	20	0	0	45	0	0	10
Future Vol, veh/h	10	810	16	42	652	20	0	0	45	0	0	10
Conflicting Peds, #/hr	17	0	10	10	0	17	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	60	-	-	80	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	1	3	1	1	3	1	1	1	1	1	1	1
Mvmt Flow	11	900	18	47	724	22	0	0	50	0	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	763	0	0	928	0	0	-	-	469	-	-	394
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	4.12	-	-	-	-	6.92	-	-	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	-	-	3.31	-	-	3.31
Pot Cap-1 Maneuver	852	-	-	739	-	-	0	0	544	0	0	608
Stage 1	-	-	-	-	-	-	0	0	-	0	0	-
Stage 2	-	-	-	-	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	838	-	-	732	-	-	-	-	539	-	-	596
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	12.4	11.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	539	838	-	-	732	-	-	596
HCM Lane V/C Ratio	0.093	0.013	-	-	0.064	-	-	0.019
HCM Control Delay (s)	12.4	9.4	-	-	10.3	-	-	11.2
HCM Lane LOS	B	A	-	-	B	-	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	0.1

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (vph)	64	150	675	620	76	76	97
Future Volume (vph)	64	150	675	620	76	76	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.2	4.9	4.9		4.2	4.2
Lane Util. Factor		1.00	0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00		1.00	1.00
Frt		1.00	1.00	0.98		1.00	0.85
Flt Protected		0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)		1787	3505	3442		1787	1599
Flt Permitted		0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)		1787	3505	3442		1787	1599
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	71	167	750	689	84	84	108
RTOR Reduction (vph)	0	0	0	11	0	0	91
Lane Group Flow (vph)	0	238	750	762	0	84	17
Confl. Peds. (#/hr)					14		
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%	1%
Turn Type	Prot	Prot	NA	NA		Prot	Perm
Protected Phases	7	7	4	8		6	
Permitted Phases							6
Actuated Green, G (s)		12.3	37.2	20.7		8.7	8.7
Effective Green, g (s)		12.3	37.2	20.7		8.7	8.7
Actuated g/C Ratio		0.22	0.68	0.38		0.16	0.16
Clearance Time (s)		4.2	4.9	4.9		4.2	4.2
Vehicle Extension (s)		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		399	2370	1295		282	252
v/s Ratio Prot		c0.13	0.21	c0.22		c0.05	
v/s Ratio Perm							0.01
v/c Ratio		0.60	0.32	0.59		0.30	0.07
Uniform Delay, d1		19.1	3.7	13.7		20.5	19.7
Progression Factor		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2		2.4	0.1	0.7		0.6	0.1
Delay (s)		21.5	3.7	14.4		21.0	19.8
Level of Service		C	A	B		C	B
Approach Delay (s)			8.0	14.4		20.4	
Approach LOS			A	B		C	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	13.3
Intersection Capacity Utilization	50.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	WB	NB	SB
Directions Served	L	L	R	R
Maximum Queue (ft)	30	50	53	31
Average Queue (ft)	4	16	26	4
95th Queue (ft)	21	40	50	21
Link Distance (ft)			862	189
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	60	80		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	UL	T	T	T	TR	L	R
Maximum Queue (ft)	170	118	140	258	259	140	117
Average Queue (ft)	52	46	70	114	104	59	61
95th Queue (ft)	100	91	123	199	208	109	94
Link Distance (ft)		688	688	2423	2423		293
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	75					150	
Storage Blk Time (%)	4	1				0	
Queuing Penalty (veh)	13	1				0	

Zone Summary

Zone wide Queuing Penalty: 15

Intersection: 1: Sierra Madre Drive & Juniper Avenue

Movement	EB	EB	WB	WB	WB	NB	SB
Directions Served	L	TR	L	T	TR	R	R
Maximum Queue (ft)	28	31	52	30	54	55	31
Average Queue (ft)	4	2	18	1	4	27	7
95th Queue (ft)	21	14	43	10	27	54	28
Link Distance (ft)		1964		227	227	862	189
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	60		80				
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2: Juniper Avenue & Bridgewater Street

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	UL	T	T	T	TR	L	R
Maximum Queue (ft)	170	138	116	140	139	100	98
Average Queue (ft)	89	50	52	81	89	43	33
95th Queue (ft)	142	111	108	132	138	81	68
Link Distance (ft)		679	679	2429	2429		293
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	75					150	
Storage Blk Time (%)	17	1					
Queuing Penalty (veh)	59	3					

Zone Summary

Zone wide Queuing Penalty: 62

Appendix J: Traffic Signal Warrants

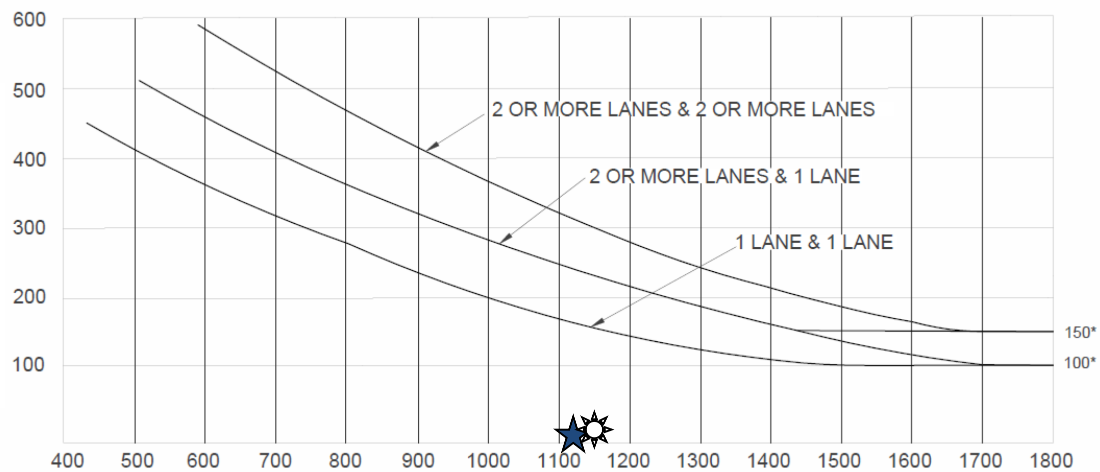
Warrant 3: Peak Hour (Urban)

Existing Traffic Conditions
1. Sierra Madre Drive / Juniper Avenue
AM (PM) Peak Hour

Sierra Madre Drive

Highest Approach Volume =

14(12) VPH



Juniper Avenue Total of Both Approaches =

1138(1117) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Not Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
Part 4: Highway Traffic Signals
November 7, 2014

www.JLBtraffic.com

info@JLBtraffic.com

516 W. Shaw Ave., Ste. 103

Fresno, CA 93704

(559) 570-8991

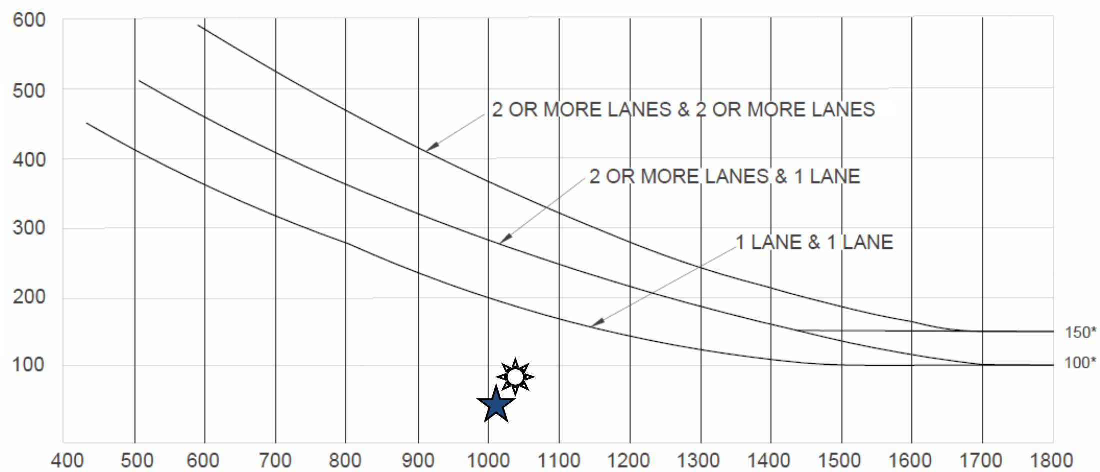
Warrant 3: Peak Hour (Urban)

Existing Traffic Conditions
2. Bridgewater Street / Juniper Avenue
AM (PM) Peak Hour

Bridgewater Street

Highest Approach Volume =

91(47) VPH



Juniper Avenue Total of Both Approaches =

1030(1004) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Not Met

PM Peak Hour – Signal Warrant is Not Met

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November 7, 2014

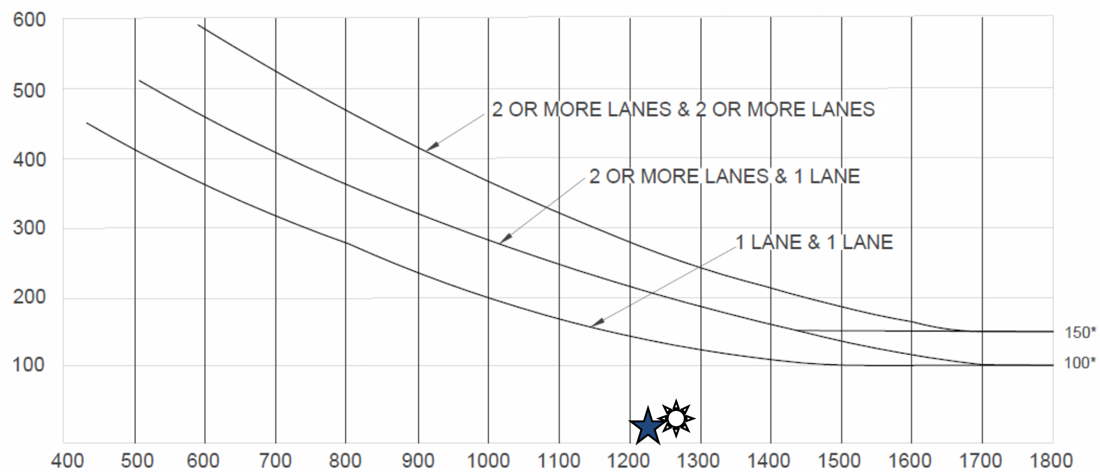
Warrant 3: Peak Hour (Urban)

Existing plus Project Traffic Conditions
1. Sierra Madre Drive / Juniper Avenue
AM (PM) Peak Hour

Sierra Madre Drive

Highest Approach Volume =

20(18) VPH



Juniper Avenue Total of Both Approaches =

1268(1227) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Not Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
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November 7, 2014

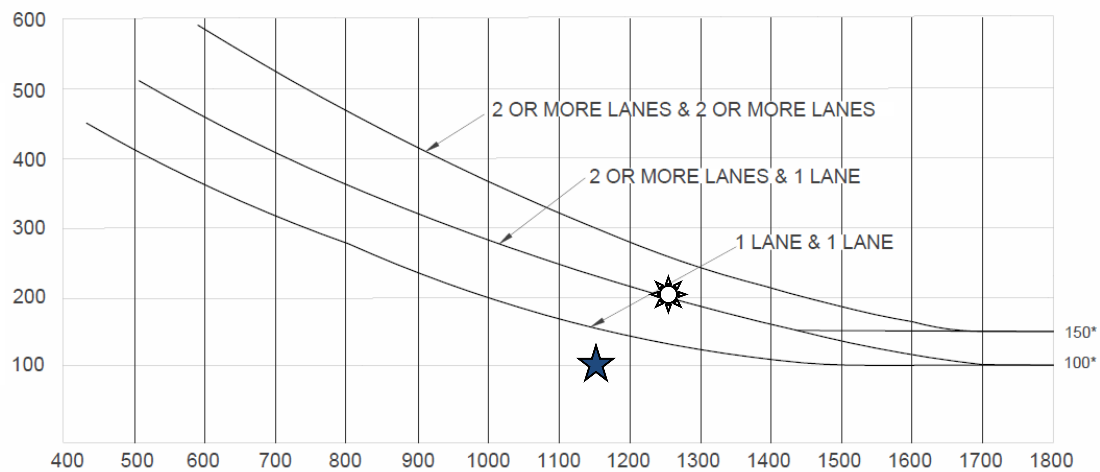
Warrant 3: Peak Hour (Urban)

Existing plus Project Traffic Conditions
2. Bridgewater Street / Juniper Avenue
AM (PM) Peak Hour

Bridgewater Street

Highest Approach Volume =

201 (101) VPH



Juniper Avenue Total of Both Approaches =

1255 (1149) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
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www.JLBtraffic.com

info@JLBtraffic.com

516 W. Shaw Ave., Ste. 103

Fresno, CA 93704

(559) 570-8991

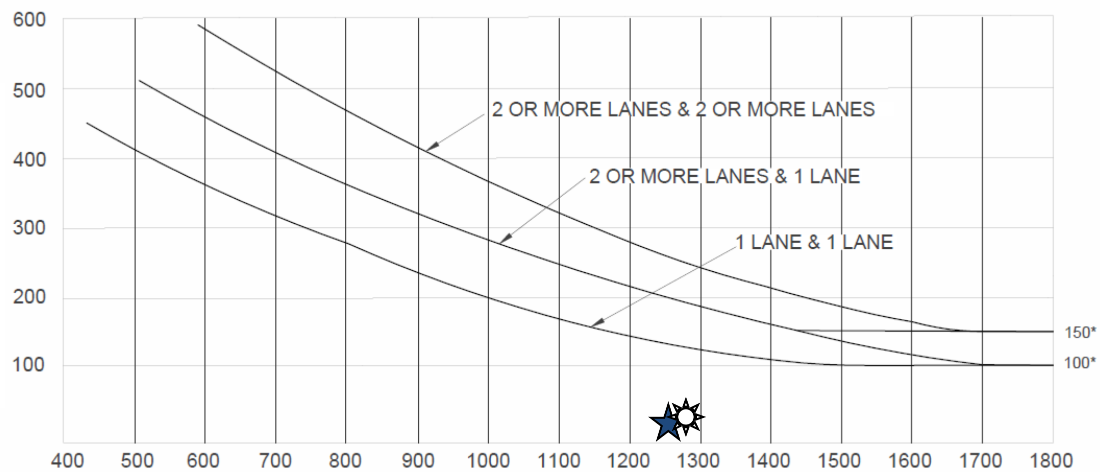
Warrant 3: Peak Hour (Urban)

Near Term plus Project Traffic Conditions
1. Sierra Madre Drive / Juniper Avenue
AM (PM) Peak Hour

Sierra Madre Drive

Highest Approach Volume =

24 (22) VPH



Juniper Avenue Total of Both Approaches =

1286 (1251) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Not Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
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www.JLBtraffic.com *Fresno, CA 93704*

info@JLBtraffic.com *(559) 570-8991*

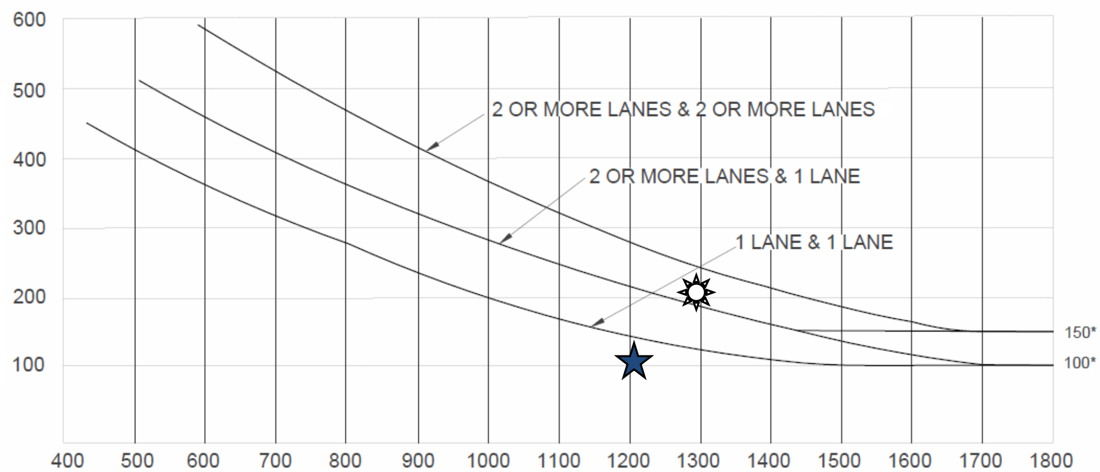
Warrant 3: Peak Hour (Urban)

Near Term plus Project Traffic Conditions
2. Bridgewater Street / Juniper Avenue
AM (PM) Peak Hour

Bridgewater Street

Highest Approach Volume =

207 (109) VPH



Juniper Avenue Total of Both Approaches =

1298 (1204) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
Part 4: Highway Traffic Signals
November 7, 2014

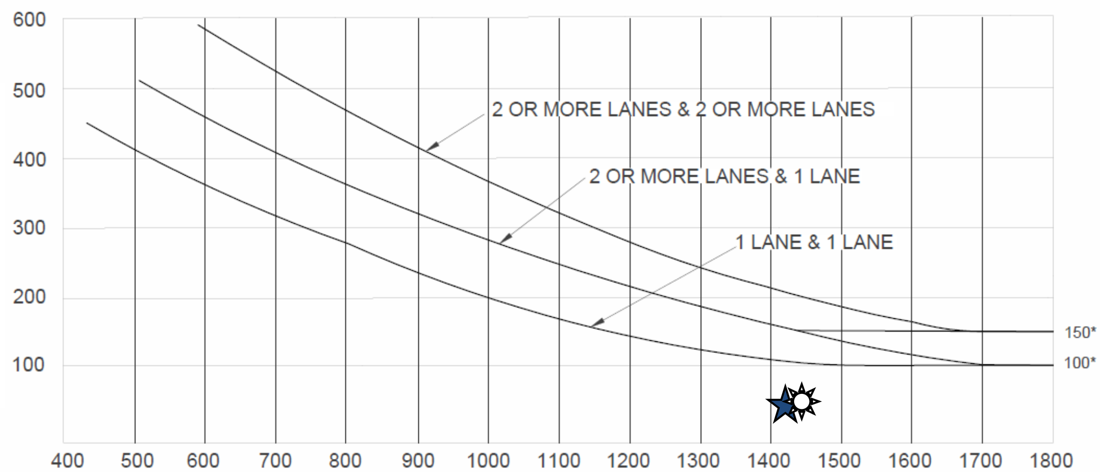
Warrant 3: Peak Hour (Urban)

Cumulative Year 2040 No Project Traffic Conditions
1. Sierra Madre Drive / Juniper Avenue
AM (PM) Peak Hour

Sierra Madre Drive

Highest Approach Volume =

53 (52) VPH



Juniper Avenue Total of Both Approaches =

1443 (1422) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Not Met

PM Peak Hour – Signal Warrant is Not Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
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www.JLBtraffic.com

info@JLBtraffic.com

516 W. Shaw Ave., Ste. 103

Fresno, CA 93704

(559) 570-8991

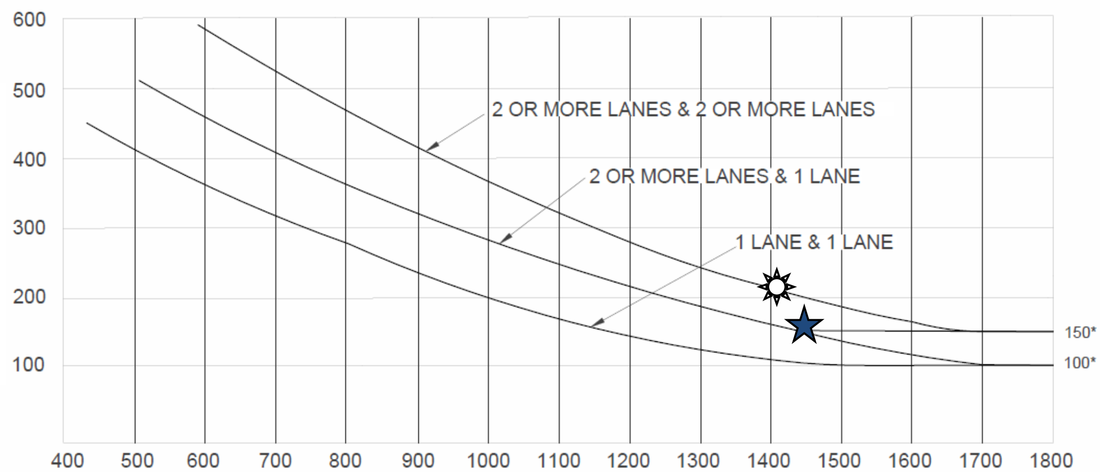
Warrant 3: Peak Hour (Urban)

Cumulative Year 2040 No Project Traffic Conditions
2. Bridgewater Street / Juniper Avenue
AM (PM) Peak Hour

Bridgewater Street

Highest Approach Volume =

218 (154) VPH



Juniper Avenue Total of Both Approaches =

1408 (1440) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Met

PM Peak Hour – Signal Warrant is Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
Part 4: Highway Traffic Signals
November 7, 2014

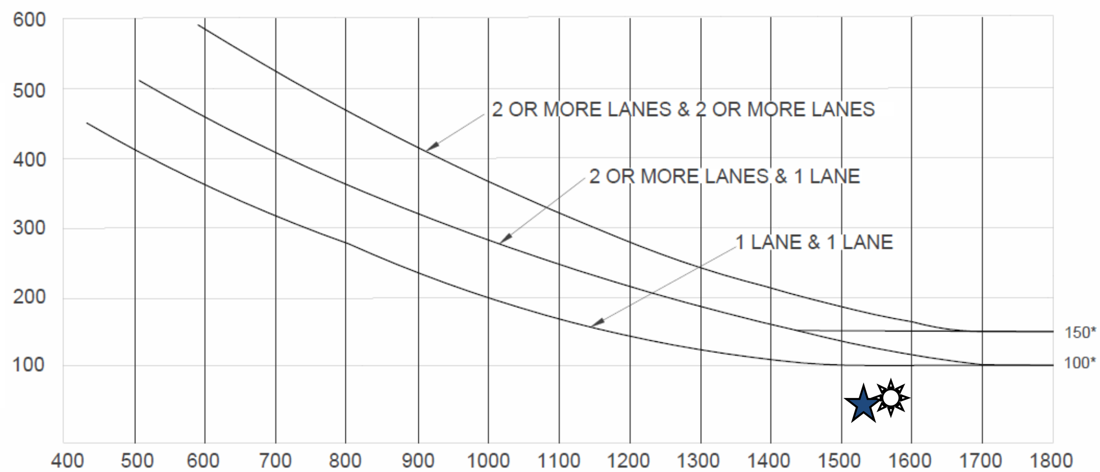
Warrant 3: Peak Hour (Urban)

Cumulative Year 2040 plus Project Traffic Conditions
1. Sierra Madre Drive / Juniper Avenue
AM (PM) Peak Hour

Sierra Madre Drive

Highest Approach Volume =

57 (54) VPH



Juniper Avenue Total of Both Approaches =

1573 (1532) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

☼ **AM Peak Hour – Signal Warrant is Not Met**

★ **PM Peak Hour – Signal Warrant is Not Met**

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
Part 4: Highway Traffic Signals
November 7, 2014

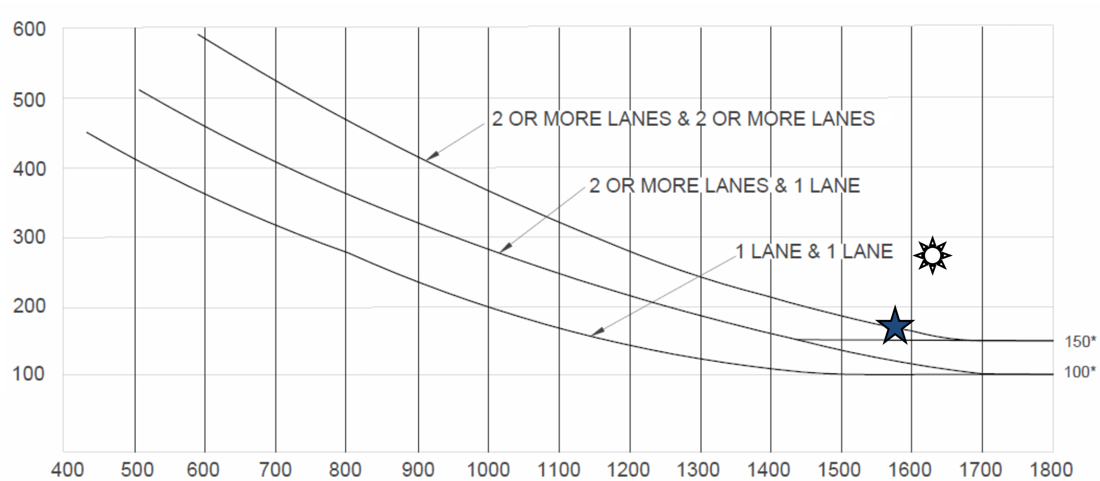
Warrant 3: Peak Hour (Urban)

Cumulative Year 2040 plus Project Traffic Conditions
2. Bridgewater Street / Juniper Avenue
AM (PM) Peak Hour

Bridgewater Street

Highest Approach Volume =

281 (173) VPH



Juniper Avenue Total of Both Approaches =

1633 (1585) VPH

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

AM Peak Hour – Signal Warrant is Met

PM Peak Hour – Signal Warrant is Met

Source: California Manual of Uniform Traffic Control Devices (CA MUTCD 2014 Edition)
Chapter 4C: Traffic Control Signal Needs Studies
Part 4: Highway Traffic Signals
November 7, 2014

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www.JLBtraffic.com

info@JLBtraffic.com

516 W. Shaw Ave., Ste. 103

Fresno, CA 93704

(559) 570-8991

Appendix H

Response to Peer Review Comments on Traffic Impact Analysis

December 31, 2020

Scott B. Odell, AICP
Odell Planning & Research, Inc.
49346 Road 426, Suite 2
Oakhurst, CA 93644

Via Email Only: scott@odellplanning.com

Subject: ***Response to Comments on the Traffic Impact Analysis Report for the Atwater Elementary School District (AESD) Elementary School located on the northwest corner of Bridgewater Street and Juniper Avenue in the City of Atwater***

Dear Mr. Odell,

JLB Traffic Engineering, Inc. (JLB) has received comments on the Traffic Impact Analysis (TIA) Report for the above referenced Project. This letter provides a response to the comments provided by AMG on December 2, 2020.

General Comment 1: Better description of the proposed parking lots and its usage needs to be provided. Is there employee only parking area, etc.

Response: *The proposed parking lots will serve both staff and visitors. At present, other than EV charging and accessible stalls there is no plan to designate any of the stalls as employee parking only; however, this can change as the school is further developed.*

General Comment 2: Juniper Avenue is an Arterial Street instead of Collector Street. On California Highway System, it is classified as Minor Arterial. https://caltrans.maps.arcgis.com/apps/webappviewer/index.html?id=026e830c914c495797c969a3e5668538

Response: *CalTrans does not have jurisdiction over city streets that are not state highways. Therefore for purposes of the TIA, the applicable roadway classification for any of the study roadways is that used by the City of Atwater under its General Plan. Based on Figure 3-7 of the City's General Plan, Juniper Avenue is classified as an "Urban Connector".*

General Comment 3: The project driveways were not analyzed. The report needs to determine if the driveways are adequate from safety and operational perspective.

Response: *JLB completed a qualitative analysis of the Project driveways consistent with that approved during the draft scope of work reviewed by the City of Atwater.*

The qualitative analysis of the Project driveways is found on page 14 of the TIA Report.

General Comment 4: Queuing analysis of the driveway is critical for this project, which was not conducted.

Response: *During the preparation of the Draft Scope of Work of the TIA JLB consulted with the City of Atwater. The main purpose for consulting with the City on the TIA draft scope of work was to seek consensus for the preparation of the TIA. As part of the City's comments to the TIA's scope of work, queuing analysis of project driveways was not requested, nor was it part of the proposed TIA draft scope of work. Nevertheless, the TIA did conduct a qualitative analysis of the project driveways and such is found on page 14 of the TIA Report.*

General Comment 5: Signal warrant analysis was not documented for Existing plus Project scenario.

Response: *Signal warrant analysis was documented for the Existing plus Project scenario. This can be found on page 18 of the TIA Report and again in Appendix J: Traffic Signal Warrants.*

Specific Comment 1: A growth rate of 1.16 was applied only to the through movement on Juniper Avenue. Since less people are using the roadway, the growth factor should be applied to all movements including the side streets.

Response: *It appears that AMG believes that counts were collected after the Covid-19 shelter in place restrictions took effect in mid-March 2020. However, it should be noted that the counts used in this TIA were collected in January 2020 prior to any Covid-19 shelter in place restrictions. Furthermore, the only reason a growth rate was applied to Juniper Avenue was because a section of the number two westbound lane was closed for construction near the intersection of Juniper Avenue and Buhach Road and while JLB's observation of the traffic in the vicinity of the lane closure did not appear to impact travel patterns, we still wanted to present a conservative analysis of the existing and future traffic impacts. Based on when the counts were collected, there is no reason why traffic from the north south streets connecting to the Juniper Avenue study intersections would have been impacted and as a result such do not need to be escalated.*

Specific Comment 2: Since Near-Term analysis was not conducted, should Near Term plus Project conditions be compared to Existing Conditions?

Response: *JLB did conduct a Near Term plus Project Analysis. This can be found starting on page 22 of the TIA Report.*

<u>Specific Comment 3:</u> Are these projects approved? How far is near term? If these projects are already approved and planned, then impact identified under Near Term plus Project conditions should be considered as a project impact. Therefore, Sierra Nevada Drive improvement should be considered as a mitigation for the proposed project. However, restricting access to other developments cannot be considered as a mitigation measure.

Response: *The Near Term projects listed in the TIA Report are those that the City agreed should be included in the Near Term plus Project scenario. These Near Term Projects have received preliminary entitlement approvals from the City.*

As described on page 22 of the TIA Report, <u>"the trip generation listed in Table IV is that which is anticipated to be added to the streets and highways by the Near Term Projects between the time of the preparation of this Report and five years after buildout of the proposed Project."</u> This was projected to be approximately the Year 2028.

Impacts which consider traffic from other projects pursuant to CEQA are cumulative impacts and not a direct project. As a result, any impacts which are not solely caused by the Project being analyzed are cumulative impacts. Therefore, the Project being analyzed is only responsible for its equitable fair share of such cumulative impacts.

Modifying intersection geometrics and traffic controls can be considered improvement measures of a cumulative impact.

<u>Specific Comment 4:</u> Typically when background growth is used, then this represents the Cumulative Year traffic conditions. Then project volume is added for Cumulative plus project conditions.

Response: *The background growth associated with the Near Term projects was added to the Near Term plus Project Scenario, and all future scenarios after that.*

<u>Specific Comment 5:</u> Plus project analysis should analyze the project driveways under all scenarios. Especially the exit driveway on Juniper Avenue.

Response: *See response to General Comment 3.*

<u>Specific Comment 6:</u> Spell SOI out -Sphere of Influence.

Response: *As was determined by reviewer, SOI stands for "Sphere of Influence"*

Specific Comment 7: Include speed limits for all roadway descriptions.

Response: *The speed limits utilized in the TIA and applicable at the time of the preparation of the TIA were as follow:*

40 miles per hour for Juniper Avenue (Per 2015 Engineering & Traffic Survey)

25 miles per hour for Sierra Madre Drive and Bridgewater Street (Prima Facie)

Specific Comment 8: Juniper Avenue is an Arterial Street instead of Collector Street. On California Highway System, it is classified as Minor Arterial.

Response: *See response to General Comment 2.*

Specific Comment 9: Warrant Analysis for Existing Plus Project Conditions are not shown in the report. The Appendix shows that the Warrant is not met at Existing Conditions, however, it meets with the project. This means the project triggers the need for a signal. Based on safety needs, operational needs, a signal is justified in existing plus project conditions.

Response: *See response to General Comment 5.*

While it is projected that the peak hour warrant for the intersection of Juniper Avenue and Bridgewater would be met during the AM peak period, its signalization is not recommended based on the traffic signal warrant and engineering judgement, especially since this intersection is projected to operate at an acceptable LOS during both peak periods. It is also worth noting that the CA MUTCD states "satisfaction of a signal warrant or warrants shall not in itself require the installation of a traffic signal." As a result, to address safety needs, JLB recommends the installation of a high-visibility crosswalk with a rapid rectangular flashing beacon (RRFB) system be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.

Specific Comment 10: How will the left turns from Juniper to the driveway be restricted?

Response: *Left turns from Juniper Avenue will be restricted via the existing raised median island.*

Specific Comment 11: With so many U-turners on a 40-mph roadway is not safe unless it is an All Way Stop Control or signalized. Even with signalization RTOR should be restricted, if that many vehicles must make U-turns. For safety reasons the signal should be installed prior to the project being open.

Response: *The number of U-turns is projected to be a maximum of 64 per hour. If all the 64 U-turns take place in 20 minutes, we would likely observe approximately three (3) U-turns per minute. Furthermore, the above comment is not based on* *empirical data nor is JLB aware of any traffic operations guidance that recommends that intersections which its main roadway is 40 MPH or greater and experiences three or more U-turns shall be controlled by All-Way Stops or traffic signals. The installation of All-Way Stops should follow guidance given by the CA MUTCD.*

Under the assumption that the intersection is signalized, restricting right turns on red (RTOR) for a situation that may occur less than one hour of the day is simply unnecessary. If the recommendation presented by AMG was a proven solution to traffic safety, a large majority of signalized intersections would have RTOR restrictions; however, this is not the case.

Regarding when a traffic signal should be installed, please see response to the second part of Specific Comment 9.

Specific Comment 12: Based on FHWA publication for 40 mph roadway, a marked mid-block crosswalk alone is insufficient since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians. https://www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf

Response: *Consistent with the referenced FHWA publication on Marked versus Unmarked crosswalks; JLB recommended that a high-visibility crosswalk with a rapid rectangular flashing beacon (RRFB) system be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.*

Specific Comment 13: RRFB is not recommended at Arterials with 40 mph speed. Minimum PHB is required. However, keeping in mind the U-turners and pedestrian safety, a signal is recommended at this intersection.

Response: *Per the CA MUTCD and Vehicle Code the prima facie speed limit on any roadway that has direct access to a school is 25 MPH when children are present. Therefore, the speed limit for Juniper Avenue adjacent and in the proximity of the Project will be 25 MPH when children are present.*

Regarding "Minimum PHB is required." comment, please see response to Specific Comment 12.

Regarding "a signal is recommended at this intersection." comment, please see response to the second part of Specific Comment 9.

Specific Comment 14: Does the current bus schedule match with school's bell schedule? If not, will some adjustment be made to serve the school?

Response: *There is no reason why the school and bus schedules cannot be coordinated.*

<u>Specific Comment 15:</u> Contains unmarked crosswalk is misleading. All intersections have unmarked crosswalks. It may be OK to state that the intersection does not have marked crosswalks.

Response: *Stating that a crosswalk is "unmarked" has no different meaning than "not marked" and as a result the use of the word "unmarked" is not misleading.*

<u>Specific Comment 16:</u> Students crossing a 40-mph corridor without a signal or HAWK is unsafe.

Response: *Please see response to the first part of Specific Comment 13.*

<u>Specific Comment 17:</u> This match with the school peak and roadway peak, which causes the traffic signal to be warranted.

Response: *The Existing plus Project traffic signal warrants were prepared pursuant to the CA MUTCD guidance and such warrants were included in the TIA. See also response to the second part of Specific Comment 9.*

<u>Specific Comment 18:</u> A mid-block crosswalk is being proposed at this intersection, which requires at least a HAWK level protection. A signal can be justified based on meeting the warrants and safety reasons.

Response: *For the first part of this comment see response to Specific Comment 12.*

For the second part of this comment see response to the second part of Specific Comment 9.

<u>Specific Comment 19:</u> Warrant 4 (pedestrian volume), Warrant 5 (School Crossing), and Warrant 7 (Crash Experience) should be completed as part of the traffic study, since the proposed project is an elementary school.

Response: *During the preparation of the Draft Scope of Work of the TIA JLB consulted with the City of Atwater. The main purpose for consulting with the City on the TIA draft scope of work was to seek consensus for the preparation of the TIA. As part of the City's comments to the TIA's scope of work, additional signal warrants besides those included in the TIA were not requested nor were they part of the proposed TIA draft scope of work.*

See also the first part of the response to Specific Comment 20 for additional information related to Warrants 4 and 5.

In order for warrant 7 to be satisfied, a minimum of three criteria need to be met. The first requires that "adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency", the second is that "five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period", and the third is that Warrant 1 or Warrant 4 be satisfied 80 percent. For this particular intersection, an adequate trial of alternatives has not taken place and based on collision data from the Statewide Integrated Traffic Records System (SWITRS) the minimum number of correctable crashes per year will also not be satisfied. Based on the traffic volumes, and estimated pedestrians Warrants 1 and 4 are also not projected to be satisfied.

Specific Comment 20: Based on 600 students and this crossing being the primary crossing for all students accessing the school from the south, it is expected that both pedestrian and school warrants would be met.

Response: *It is unreasonable to make a statement that warrants 4 and 5 are expected to be met. It should be noted that approximately 20% or less of the future students will likely live in the area south of Juniper Avenue between Shaffer Road and Buhach Road. Of these, a large percentage will be driven to school by their parents or guardians. Therefore, is largely improvable that the Juniper Avenue crossing will yield 107 or more pedestrian crossings per hour for each of four hours or 235 pedestrians per hour for one hour to meet condition A or B of warrant 4, respectively. Finally, warrant 5 cannot be completed with any degree of accuracy until the elementary school is in operation and consideration has been given to the implementation of other remedial measures, such as warning signs and flashers, and school speed zones. This is one reason why JLB has recommended the installation of a high visibility crosswalk with a rapid rectangular flashing beacon (RRFB) system be implemented across the west leg of the intersection of Bridgewater Street and Juniper Avenue.*

See also the first part of the response to Specific Comment 19.

Specific Comment 21: Indicate if there is employee/staff parking only location.

Response: *See response to General Comment 1.*

Specific Comment 22: How is left turn being allowed at the driveway when mitigation measure recommends restricting left turn at the adjacent intersection? The report should show LOS analysis for the driveway. It is expected that the left turn would not operate at acceptable levels and it would lead to queuing and blocking the drop off zone. In addition, it could be unsafe to merge into traffic at 40 mph.

Response: *The southbound left turn from the Project is not restricted because they can utilize the existing continuous two way left turn lane to merge onto eastbound traffic. Furthermore, the effective speeds for Juniper Avenue during the school peak periods would be 25 MPH and not 40 MPH as stated in this comment. Finally, is understood that left turn movements experience higher delays when compared to right turn movements and for this reason the Project exit driveway to Juniper Avenue is being planned with two exit lanes (one for left turns and the other for right turns). The two exit lanes will help minimize queuing or blocking of the drop of zone.*

Specific Comment 23: Same comments from Existing conditions warrant analysis. It meets the warrant, and it shows that the project triggers the signal warrant to be met.

Response: *See response to the second part of Specific Comment 9.*

Specific Comment 24: This is being caused by the additional trips from the School. Restricting access is not a mitigation measure. Will the school be responsible to gain consensus from residents? Can this be completed prior to the school being built?

Response: *The operational impacts at the intersection of Juniper and Sierra Madre Drive are not direct impacts of the Project. The operational impacts are projected to take place once cumulative projects are considered. As a result, the operational impact to the intersection of Juniper Avenue at Sierra Madre Drive is a cumulative impact.*

Modifying intersection geometrics and traffic controls can be considered improvement measures of a cumulative impact.

Development projects are not required to seek consensus from residents. It is up to the elected body of the lead or responsible agency to make such decisions.

Finally, given that the projected operational deficiencies are a result of cumulative impacts, the Project is only responsible for its equitable fair share as presented on page 32 of the TIA.

Specific Comment 25: The traffic volume shows that SBL is the primary movement at this intersection.

Response: *Comment noted. There is a total of 14 AM peak hour and 9 PM peak hour southbound left turn trips.*

Specific Comment 26: Would residents at Sierra Nevada Drive be OK with additional trips through their neighborhood?

Response: *It is important to note that the residents that use the Sierra Nevada Drive are the same residents that utilize Sierra Madre Drive. Both roadways serve the same gated community and since the community is gated, no additional traffic would be routed through the community.*

<u>Specific Comment 27:</u> Mitigated scenario should analyze the Sierra Nevada intersection, since trips are being diverted to that intersection. It is expected that the diverted trips would cause that intersection to fail.

Response: *It is JLB's opinion that redirecting 14 AM peak hour and 9 PM peak hour southbound lefts to Sierra Nevada Drive will not result in a significant impact to generally acceptable LOS standards and as a result additional analysis is not recommended.*

<u>Specific Comment 28:</u> Peak period warrant analysis means it is met based on any one hour of peak data. It does not matter if it satisfies it during one peak or two peaks. What other differences are there to justify it at Cumulative Conditions? Does it meet the 4-hr or 8-hr warrant? Or any additional information that justifies the recommendation?

Response: *Again, it is worth noting that the CA MUTCD states "satisfaction of a signal warrant or warrants shall not in itself require the installation of a traffic signal."*

The main differences between the Cumulative Year 2040 scenarios and the prior plus project scenario is that is that LOS and operations under the Cumulative Year scenarios are projected to deteriorate beyond generally acceptable levels at the intersection of Juniper Avenue and Bridgewater Street. Under the Cumulative Year 2040 scenarios, the only feasible option to improve the cumulative impacts is the installation of the traffic signal.

The 4-hour and 8-hour warrants can only be reasonably be conducted for existing traffic conditions. This is why most Central Valley responsible agencies prepare the 4-hour and 8-hour warrants for existing conditions only .

Regarding the last part of this comment, see the second paragraph of this response.

<u>Specific Comment 29:</u> Similar queuing analysis should be conducted for the proposed project driveway.

Response: *See response to General Comment 4.*

<u>Specific Comment 30:</u> How was PM peak considered to be the critical peak? The project adds 422 project trips in AM and 276 project trips in PM to the roadway network. So, AM peak should be used for the Fair Share Calculation.

Response: *Fair share calculations are needed to address the worst case impacts at the study facilities. In this case the worst case impacts take place during the PM peak and not the AM peak. As a result, the PM peak is the critical peak.*

Specific Comment 31: The fair share calculation should have been done for the AM peak period, which is critical to the proposed project since it coincides with the AM peak period for adjacent roadways. The fair share calculation for AM results in 27.5% for Intersection 1 and 38.6% for intersection 2.

Response: *Please see response to Specific Comment 30. Furthermore, the fair share impacts of the future roadway improvements as presented on page 32 are the appropriate percentages given that the critical peak LOS operations take place during the PM peak period.*

Specific Comment 32: The fair share contribution should be corrected. However, based on project's impact on safety, U-turn requirements, pedestrian/student crossing safety, and signal warrant triggering, a signal is needed under Existing plus Project conditions. The installation of the signal should be part of the proposed project to avoid safety and operational impacts. Therefore, fair share calculation may not be needed for this report.

Response: *See responses to Specific Comments 30 and 31. Furthermore, the Project site has long been planned for a school and therefore the Project is not adding a land use that was not previously planned for by the City's General Plan and as a result any impacts related to any intersections improvements are cumulative impacts which in turn fair share impact percentages would be appropriate.*

If you have any questions or require additional information, please contact me by phone at (559) 570-8991 or by e-mail at jbenavides@jlbtraffic.com.

Sincerely,

Jose Luis Benavides, PE, TE
President

Enclosed: AMG Comment Letter

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To:	**Mr. Greg Thomson** **Director of Public Works/Community Development** **City of Atwater** **750 Bellevue Road** **Atwater, CA 95301**	**From:**	**Joy Bhattacharya, PE, PTOE** **joy@amobility.com** **415-688-0024**
Email:	gthompson@atwater.org	Date:	December 2, 2020

Reference: **Peer Review of Traffic Impact Study prepared for an AESD Elementary School**

The purpose of this technical memorandum is to present AMG's comments on the Traffic Impact Analysis (TIA) Study for an Atwater Elementary School District (AESD) Elementary School located on the northwest corner of Bridgewater Street and Juniper Avenue in the City of Atwater.

TIA Summary

- TIS was prepared for a proposed Elementary School on the northwest corner of Bridgewater Street and Juniper Avenue
- Dated September 3, 2020
- Prepared By: JLB Traffic Engineering, Inc. (JLB)
- Prepared For: Odell Planning & Research, Inc. and AESD
- Project Description: Elementary School
    - Size - 600 students

Based on our review of the report, AMG has determined that the report is a comprehensive document, and it has been prepared consistent to the TIA Guidelines. Overall, it is a very well-written and well-organized report. There are few minor grammatical errors, but we have not marked them up since our review was focused on technical items. To make the document more accurate and complete, AMG has the following comments:

General Comments

1. Better description of the proposed parking lots and its usage needs to be provided. Is there employee only parking area, etc.
2. Juniper Avenue is an Arterial Street instead of Collector Street. On California Highway System, it is classified as Minor Arterial. https://caltrans.maps.arcgis.com/apps/webappviewer/index.html?id=026e830c914c495797c969a3e5668538The project driveways were not analyzed.
3. The report needs to determine if the driveways are adequate from safety and operational perspective
4. Queuing analysis of the driveway is critical for this project, which was not conducted

5. Signal warrant analysis was not documented for Existing plus Project scenario

Specific Comments

1. **Page 5** – A growth rate of 1.16 was applied only to the through movement on Juniper Avenue. Since less people are using the roadway, the growth factor should be applied to all movements including the side streets.
2. **Page 6** - Since Near-Term analysis was not conducted, should Near Term plus Project conditions be compared to Existing Conditions?
3. **Page 6** - Are these projects approved? How far is near term? If these projects are already approved and planned, then impact identified under Near Term plus Project conditions should be considered as a project impact. Therefore, Sierra Nevada Drive improvement should be considered as a mitigation for the proposed project. <u>However, restricting access to other developments cannot be considered as a mitigation measure.</u>
4. **Page 6** - Typically when background growth is used, then this represents the Cumulative Year traffic conditions. Then project volume is added for Cumulative plus project conditions
5. **Page 6** - Plus project analysis should analyze the project driveways under all scenarios. Especially the exit driveway on Juniper Avenue.
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7. **Page 10** - Include speed limits for all roadway descriptions.
8. **Page 10** - Juniper Avenue is an Arterial Street instead of Collector Street. On California Highway System, it is classified as Minor Arterial.
9. **Page 14** - Warrant Analysis for Existing Plus Project Conditions are not shown in the report. The Appendix shows that the Warrant is not met at Existing Conditions, however, it meets with the project. This means the project triggers the need for a signal. Based on safety needs, operational needs, a signal is justified in existing plus project conditions.
10. **Page 14** - How will the left turns from Juniper to the driveway be restricted?
11. **Page 14** - With so many U-turners on a 40-mph roadway is not safe unless it is an All Way Stop Control or signalized. Even with signalization RTOR should be restricted, if that many vehicles must make U-turns. For safety reasons the signal should be installed prior to the project being open.
12. **Page 15** - Based on FHWA publication for 40 mph roadway, a marked mid-block crosswalk alone is insufficient since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.
Đttps://www.fhwa.dot.gov/publications/research/safety/04100/04100.pdf
13. **Page 15** - RRFB is not recommended at Arterials with 40 mph speed. Minimum PHB is required. However, keeping in mind the U-turners and pedestrian safety, a signal is recommended at this intersection.
14. **Page 15** - Does the current bus schedule match with school's bell schedule? If not, will some adjustment be made to serve the school?

15. **Page 16** - Contains unmarked crosswalk is misleading. All intersections have unmarked crosswalks. It may be OK to state that the intersection does not have marked crosswalks
16. **Page 16** - students crossing a 40-mph corridor without a signal or HAWK is unsafe.
17. **Page 18** - This match with the school peak and roadway peak, which causes the traffic signal to be warranted.
18. **Page 18** - A mid-block crosswalk is being proposed at this intersection, which requires at least a HAWK level protection. A signal can be justified based on meeting the warrants and safety reasons.
19. **Page 18** - Warrant 4 (pedestrian volume), Warrant 5 (School Crossing), and Warrant 7 (Crash Experience) should be completed as part of the traffic study, since the proposed project is an elementary school.
20. Based on 600 students and this crossing being the primary crossing for all students accessing the school from the south, it is expected that both pedestrian and school warrants would be met.
21. **Figure 3** – Indicate if there is employee/staff parking only location.
22. **Figure 3** – How is left turn being allowed at the driveway when mitigation measure recommends restricting left turn at the adjacent intersection? The report should show LOS analysis for the driveway. It is expected that the left turn would not operate at acceptable levels and it would lead to queuing and blocking the drop off zone. In addition, it could be unsafe to merge into traffic at 40 mph.
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24. **Page 23** - This is being caused by the additional trips from the School. Restricting access is not a mitigation measure. Will the school be responsible to gain consensus from residents? Can this be completed prior to the school being built?
25. **Page 23** - The traffic volume shows that SBL is the primary movement at this intersection.
26. **Page 23** - Would residents at Sierra Nevada Drive be OK with additional trips through their neighborhood?
27. **Page 23** - Mitigated scenario should analyze the Sierra Nevada intersection, since trips are being diverted to that intersection. It is expected that the diverted trips would cause that intersection to fail.
28. **Page 23** - Peak period warrant analysis means it is met based on any one hour of peak data. It does not matter if it satisfies it during one peak or two peaks. What other differences are there to justify it at Cumulative Conditions? Does it meet the 4-hr or 8-hr warrant? Or any additional information that justifies the recommendation?
29. **Page 31** - similar queuing analysis should be conducted for the proposed project driveway.
30. **Page 31** - How was PM peak considered to be the critical peak? The project adds 422 project trips in AM and 276 project trips in PM to the roadway network. So, AM peak should be used for the Fair Share Calculation.
31. **Page 31** - The fair share calculation should have been done for the AM peak period, which is critical to the proposed project since it coincides with the AM peak period for adjacent roadways. The fair share calculation for AM results in 27.5% for Intersection 1 and 38.6% for intersection 2.

32. **Page 31** - The fair share contribution should be corrected. However, based on project's impact on safety, U-turn requirements, pedestrian/student crossing safety, and signal warrant triggering, a signal is needed under Existing plus Project conditions. The installation of the signal should be part of the proposed project to avoid safety and operational impacts. Therefore, fair share calculation may not be needed for this report.

All the above comments need to be analyzed, which would require additional traffic analysis and revise the conclusions of the report. Please respond to the comments that according to the preparer is not needed to be addressed. Please feel free to contact us if there are any questions or concerns regarding this review.

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