# APPENDIX 1

## Air Quality & Greenhouse Gas Impact Assessment

**(Note: Appendices to Appendix 1 are available upon request by contacting Daniel Brannick at daniel@odellplanning.com or (559) 472-7167)**

# AIR QUALITY & GREENHOUSE GAS IMPACT ASSESSMENT

FOR THE PROPOSED

## NEW SOUTHEAST FRESNO ELEMENTARY SCHOOL PROJECT

CITY OF FRESNO, CA

JULY 2021


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LIST OF COMMON TERMS & ACRONYMS

| | |
|---|---|
| AB | Assembly Bill |
| ACBM | Asbestos-Containing Building Material |
| ACM | Asbestos-Containing Material |
| AHERA | Asbestos Hazard Emergency Response Act |
| APCD | Air Pollution Control District |
| APS | Alternative Planning Strategy |
| ARB | California Air Resources Board |
| ATCM | Airborne Toxic Control Measure |
| BAU | Business As Usual |
| BPS | Best Performance Standards |
| BSC | Building Standards Commission |
| $C_2H_3Cl$ | Vinyl Chloride |
| CAAQS | California Ambient Air Quality Standards |
| CAFE | Corporate Average Fuel Economy |
| CalEEMod | California Emissions Estimator Model |
| CalEPA | California Environmental Protection Agency |
| CBC | California Building Code |
| CCAA | California Clean Air Act |
| CCR | California Code of Regulation |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulation |
| $CH_4$ | Methane |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| $CO_2e$ | Carbon Dioxide Equivalent |
| DPM | Diesel-Exhaust Particulate Matter |
| DRRP | Diesel Risk Reduction Plan |
| EO | Executive Order |
| FCAA | Federal Clean Air Act |
| FIP | Federal Implementation Plan |
| GHG | Greenhouse Gases |
| GWP | Global Warming Potential |
| $H_2S$ | Hydrogen Sulfide |
| HAP | Hazardous Air Pollutant |
| HFC | Hydrofluorocarbons |
| ISR | Indirect Source Review |
| lbs/day | Pounds per day |
| LOS | Level of Service |
| $MMTCO_2e$ | Million Metric Tons of Carbon Dioxide Equivalents |
| MPO | Metropolitan Planning Organizations |
| $N_2O$ | Nitrous Oxide |
| NAAQS | National Ambient Air Quality Standards |
| NESHAPs | National Emission Standards for HAPs |
| $NF_3$ | Nitrogen Trifluoride |
| NHTSA | National Highway Traffic Safety Administration |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Oxides of Nitrogen |
| $O_3$ | Ozone |
| OPR | Office of Planning and Research |
| OSHA | Occupational Safety and Health Administration |
| Pb | Lead |
| PFC | Perfluorocarbons |
| PM | Particulate Matter |
| $PM_{10}$ | Particulate Matter (less than 10 µm) |
| $PM_{2.5}$ | Particulate Matter (less than 2.5 µm) |
| ppm | Parts per Million |
| PVC | Polyvinyl Chloride |
| ROG | Reactive Organic Gases |
| SAFE | Safer Affordable Fuel-Efficient |
| SB | Senate Bill |
| SCAQMD | South Coast Air Quality Management District |
| SCS | Sustainable Communities Strategy |
| $SF_6$ | Sulfur Hexafluoride |

| | |
|---|---|
| SIP | State Implementation Plan |
| SJVAB | San Joaquin Valley Air Basin |
| SJVAPCD | San Joaquin Valley Air Pollution Control District |
| SLCP | Short-Lived Climate Pollutants |
| SLOAPCD | San Luis Obispo County Air Pollution Control District |
| $SO_2$ | Sulfur Dioxide |
| $SO_4^{2-}$ | Sulfate |
| $SO_x$ | Oxides of Sulfur |
| SP | Service Population |
| TAC | Toxic Air Contaminant |
| TOG | Total Organic Gas |
| U.S. EPA | United States Environmental Protection Agency |
| UFP | Ultrafine Particles |
| VOC | Volatile Organic Compounds |

# INTRODUCTION

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

## PROPOSED PROJECT

The Sanger Unified School District (District) is proposing to undertake the New Southeast Fresno Elementary School Project (project).

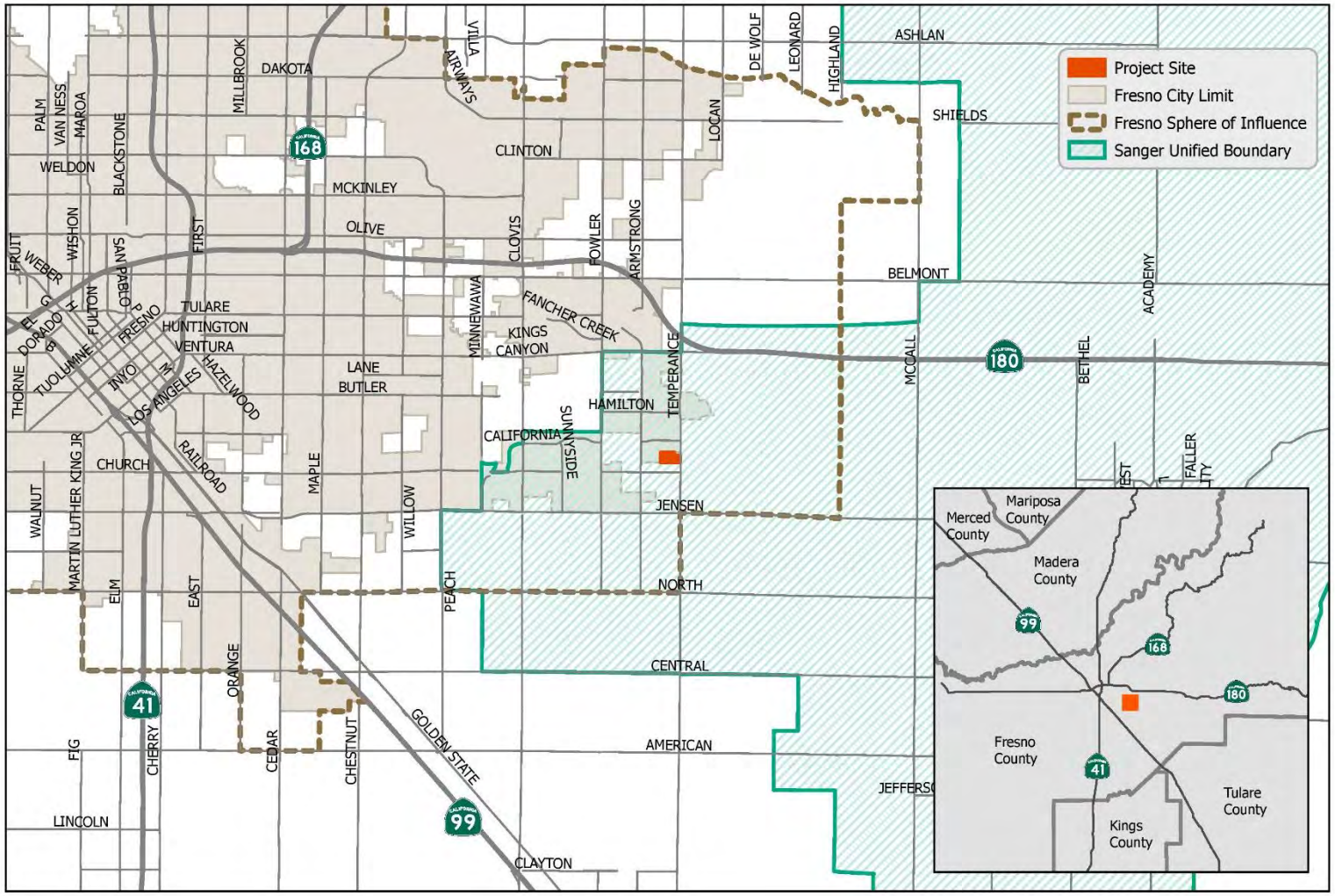
The project site encompasses 17.93 acres located on the west side of Temperance Avenue approximately 700 feet north of Church Avenue in an unincorporated portion of Fresno County, California (APNs 316-160-46 and 316-160-72). The site is immediately adjacent to the City of Fresno's city limits and is within the Fresno Sphere of Influence. The location of the project site is displayed in Figures AQ-1 and AQ-2.

The District is proposing to develop the New Southeast Fresno Elementary School Project to serve the anticipated student enrollment growth generated by new urban development within southeast Fresno. The proposed elementary school will be designed to provide capacity for approximately 700 students in kindergarten through sixth grades. This campus will have approximately 45 employees (including administrators, faculty, and support staff). Facilities planned as part of the project include administrative offices, classrooms, a multi-purpose building, sport fields, physical education facilities, and parking areas (refer to Figure AQ-3). Instructional activities at the elementary school will be in regular session on weekdays from late August to early June, with additional special events and classes during evenings, on weekends, and during the summer recess.

The project includes the annexation of the site to the City of Fresno. It is anticipated that the project will be served by the City of Fresno's water and sewer systems.

Construction of the project will likely begin within the next five years to coincide with planned residential development in the area and funding availability.

## Figure AQ-1. Project Location




**Project Location** **Figure 1**

New Southeast Fresno Elementary School Project
Sanger Unified School District

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

**Figure AQ-2. Project Site**

**Figure AQ-3. Project Site Plan**

# 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 and 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 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.

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°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, the 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 is semi-arid, with an annual average precipitation of approximately 11 inches. Temperatures in the project area range from an average minimum of approximately 37°F, in December, to an average maximum of 98°F, in July (WRCC 2021).

*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 an air pollutant 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 1 hour, 8 hours, 24 hours, or 1 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.

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. It is a secondary pollutant that is formed when oxides of nitrogen and volatile organic compounds react in the presence of sunlight. $O_3$ 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, $O_3$ exists naturally and shields Earth from harmful ultraviolet radiation.

High concentrations of ground-level $O_3$ can adversely affect the human respiratory system and aggravate cardiovascular disease and many respiratory ailments. $O_3$ also damages natural ecosystems such as forests and foothill communities, 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) include all of the ROGs, in addition to low reactivity organic compounds like methane and acetone. ROGs and volatile organic compounds 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 $O_3$. 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 are a precursor to the formation of $O_3$ 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 temperatures 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 (ARB 2020c):

- "Inhalable coarse particles ($PM_{10}$)," such as those found near roadways and dusty industries, are between 2.5 and 10 micrometers in diameter. $PM_{10}$ 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 particulate matter 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 $O_3$). 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 $O_3$ 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 (Caltrans 1996).

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 oxides of sulfur ($SO_X$) particles contribute to 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. Pb is neither created nor destroyed in the environment, so it essentially persists forever. The health effects of Pb poisoning include loss of appetite, weakness, apathy, and miscarriage. Pb can also cause lesions of the neuromuscular system, circulatory system, brain, and gastrointestinal tract. Gasoline-powered automobile engines were a major source of airborne Pb through the use of leaded fuels. The use of leaded fuel has been mostly phased out, with the result that ambient concentrations of Pb 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. $H_2S$ is extremely hazardous in high concentrations; especially in enclosed spaces (800 parts per million [ppm] can cause death). The Occupational Safety and Health Administration (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 $H_2S$, sulfates, vinyl chloride, and visibility reducing particles. The following section summarizes these pollutants and describes 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. $SO_4^{2-}$ 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 $SO_4^{2-}$ compounds in the atmosphere. The conversion of $SO_2$ to $SO_4^{2-}$ takes place rapidly and completely in urban areas of California due to regional meteorological features.

The ARB $SO_4^{2-}$ standard is designed to prevent aggravation of respiratory symptoms. Effects of $SO_4^{2-}$ exposure at levels above the standard include a decrease in ventilator function, aggravation of asthmatic symptoms, and an increased risk of cardiopulmonary disease. $SO_4^{2-}$ are particularly effective in degrading visibility, and, because 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 ($C_2H_3Cl$) 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. $C_2H_3Cl$ 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. 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 government has 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 the local government 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 NAAQS or California Ambient Air Quality Standards (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 level, 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 (Assembly Bill [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. The following provides a summary of the primary TACs of concern within the State of California and related health effects:

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 percent of the statewide total DPM emissions, 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 the 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.

Acetaldehyde is a federal HAP. The ARB identified acetaldehyde as a TAC in April 1993. Acetaldehyde is both directly emitted into the atmosphere and formed in the atmosphere as a result of photochemical oxidation. Sources of acetaldehyde include emissions from combustion processes such as exhaust from mobile sources and fuel combustion from stationary internal combustion engines, boilers, and process heaters. A majority of the statewide acetaldehyde emissions can be attributed to mobile sources, including on-road motor vehicles, construction and mining equipment, aircraft, recreational boats, and agricultural equipment. Area sources of emissions include the burning of wood in residential fireplaces and wood stoves. The primary stationary sources of acetaldehyde are fuel combustion from the petroleum industry (ARB 2013).

Acute exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic intoxication of acetaldehyde resemble those of alcoholism. The U.S. EPA has classified acetaldehyde as a probable human carcinogen. In California, acetaldehyde was classified on April 1, 1988, as a chemical known to the state to cause cancer (U.S. EPA 2014, ARB 2013).

Benzene is highly carcinogenic and occurs throughout California. The ARB identified benzene as a TAC in January 1985. A majority of benzene emitted in California (roughly 88 percent) comes from motor vehicles, including evaporative leakage and unburned fuel exhaust. These sources include on-road motor vehicles, recreational boats, off-road recreational vehicles, and lawn and garden equipment. Benzene is also formed as a partial combustion product of larger aromatic fuel components. To a lesser extent, industry-related stationary sources are also sources of benzene emissions. The primary stationary sources of reported benzene emissions are crude petroleum and natural gas mining, petroleum refining, and electric generation that involves the use of petroleum products. The primary area sources include residential combustion of various types such as cooking and water heating (ARB 2013).

Acute inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidences of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. The U.S. EPA has classified benzene as a known human carcinogen for all routes of exposure (U.S. EPA 2014).

1,3-butadiene was identified by the ARB as a TAC in 1992. Most of the emissions of 1,3-butadiene are from incomplete combustion of gasoline and diesel fuels. Mobile sources account for a majority of the total statewide emissions. Additional sources include agricultural waste burning, open burning associated with forest management, petroleum refining, manufacturing of synthetics and man-made materials, and oil and gas extraction. The primary natural sources of 1,3-butadiene emissions are wildfires (ARB 2013).

Acute exposure to 1,3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Epidemiological studies have reported a possible association between 1,3-butadiene exposure and cardiovascular diseases. Epidemiological studies of workers in rubber plants have shown an association between 1,3-butadiene exposure and increased incidence of leukemia. Animal studies have reported tumors at various sites from 1,3-butadiene exposure. In California, 1,3-butadiene has been identified as a carcinogen.

Carbon Tetrachloride was identified by the ARB as a TAC in 1987 under California's TAC program. The primary stationary sources reporting emissions of carbon tetrachloride include chemical and allied product manufacturers and petroleum refineries. In the past, carbon tetrachloride was used for dry cleaning and as a grain fumigant. Usage for these purposes is no longer allowed in the United States. Carbon tetrachloride has not been registered for pesticide use in California since 1987. Also, the use of carbon tetrachloride in products to be used indoors has been discontinued in the United States. The statewide emissions of carbon tetrachloride are small (about 1.96 tons per year), and background concentrations account for most of the health risks (ARB 2013).

The primary effects of carbon tetrachloride in humans are on the liver, kidneys, and central nervous system. Human symptoms of acute inhalation and oral exposures to carbon tetrachloride include headache, weakness, lethargy, nausea, and vomiting. Acute exposures to higher levels and chronic (long-term) inhalation or oral exposure to carbon tetrachloride produces liver and kidney damage in humans. Human data on the carcinogenic effects of carbon tetrachloride are limited. Studies in animals have shown that ingestion of carbon tetrachloride increases the risk of liver cancer. In California, carbon tetrachloride has been identified as a carcinogen.

Hexavalent chromium was identified as a TAC in 1986. Sources of Hexavalent chromium include industrial metal finishing processes, such as chrome plating and chromic acid anodizing, and firebrick lining of glass furnaces. Other sources include mobile sources, including gasoline motor vehicles, trains, and ships (ARB 2013).

The respiratory tract is the major target organ for hexavalent chromium toxicity, for acute and chronic inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to hexavalent chromium, while perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, and other respiratory effects have been noted from chronic exposure. Human studies have established that inhaled hexavalent chromium is a human carcinogen, resulting in an increased risk of lung cancer. In California, hexavalent chromium has been identified as a carcinogen.

Para-Dichlorobenzene was identified by the ARB as a TAC in April 1993. The primary area-wide sources that have reported emissions of para-dichlorobenzene include consumer products such as non-aerosol insect repellants and solid/gel air fresheners. These sources contribute to nearly all of the statewide para-dichlorobenzene emissions (ARB 2013).

Acute exposure to paradichlorobenzene via inhalation results in irritation to the eyes, skin, and throat in humans. In addition, long-term inhalation exposure may affect the liver, skin, and central nervous system in humans. The U.S. EPA has classified para-dichlorobenzene as a possible human carcinogen.

Formaldehyde was identified by the ARB as a TAC in 1992. Formaldehyde is both directly emitted into the atmosphere and formed in the atmosphere as a result of photochemical oxidation. Photochemical oxidation is the largest source of formaldehyde concentrations in California ambient air. Directly emitted formaldehyde is a product of incomplete combustion. One of the primary sources of directly emitted formaldehyde is vehicular exhaust. Formaldehyde is also used in resins, can be found in many consumer products as an antimicrobial agent, and is also used in fumigants and soil disinfectants. The primary area sources of formaldehyde emissions include wood burning in residential fireplaces and wood stoves (ARB 2013).

Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute and chronic inhalation exposure to formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an

increased incidence of nasal squamous cell cancer. Formaldehyde is classified as a probable human carcinogen.

Methylene Chloride was identified by the ARB as a TAC in 1987. Methylene chloride is used as a solvent, a blowing and cleaning agent in the manufacture of polyurethane foam and plastic fabrication, and as a solvent in paint stripping operations. Paint removers account for the largest use of methylene chloride in California, where methylene chloride is the main ingredient in many paint stripping formulations. Plastic product manufacturers, manufacturers of synthetics, and aircraft and parts manufacturers are stationary sources reporting emissions of methylene chloride (ARB 2013).

The acute effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic exposure to methylene chloride suggest that the central nervous system is a potential target in humans and animals. Human data are inconclusive regarding methylene chloride and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of methylene chloride. In California, methylene chloride has been identified as a carcinogen.

Perchloroethylene was identified by the ARB as a TAC in 1991. Perchloroethylene is used as a solvent, primarily in dry cleaning operations. Perchloroethylene is also used in degreasing operations, paints and coatings, adhesives, aerosols, specialty chemical production, printing inks, silicones, rug shampoos, and laboratory solvents. In California, the stationary sources that have reported emissions of perchloroethylene are dry cleaning plants, aircraft part and equipment manufacturers, and fabricated metal product manufacturers. The primary area sources include consumer products such as automotive brake cleaners and tire sealants and inflators (ARB 2013).

Acute inhalation exposure to perchloroethylene vapors can result in irritation of the upper respiratory tract and eyes, kidney dysfunction, and at lower concentrations, neurological effects, such as reversible mood and behavioral changes, impairment of coordination, dizziness, headaches sleepiness, and unconsciousness. Chronic inhalation exposure can result in neurological effects, including sensory symptoms such as headaches, impairments in cognitive and motor neurobehavioral functioning, and color vision decrements. Cardiac arrhythmia, liver damage, and possible kidney damage may also occur. In California, perchloroethylene 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, are abundant in the Sierra foothills, the Klamath Mountains, and Coast Ranges.

Asbestos is commonly found in ultramafic rock, including serpentine, and near fault zones. The amount of asbestos that is typically present in these rocks ranges 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 1900s; 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 prohibit 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 asbestos exposure. 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 diseases, 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, 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 percentage 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 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 are thought to grow best in the 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 California. How 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 2020).

### 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 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 AQ-1.

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 a 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 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 to inspect their schools for asbestos-containing building materials (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.

### *National Emission Standards for Hazardous Air Pollutants*

Pursuant to the FCAA of 1970, the U.S. EPA established the NESHAP. These are technology-based source-specific regulations that limit allowable emissions of HAPs.

## 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 CCAA of 1988. Other ARB duties include monitoring air quality (in conjunction with air monitoring networks maintained by air pollution control districts (APCD) and air quality management districts), establishing 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 AQ-1. 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 $O_3$, 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 5 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.

**Table AQ-1. 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%. | |

ppm = parts per million by volume; ppb = parts per billion by volume; µg/m³ = micrograms per cubic meter
Source: ARB 2020a

*California Assembly Bill 170*

AB 170, Reyes, 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.

*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.

*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 vehicles 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 5 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 5 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 apply to the proposed project include, but are not limited to, the following:

- *Regulation VIII (Fugitive $PM_{10}$ 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 track out, paved and unpaved roads, bulk material handling and storage, unpaved vehicle/traffic areas, open space areas, etc.
- *Rule 4002 (NESHAP).* 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 ACBM. Removal of identified ACBM must be removed by a certified asbestos contractor in accordance with 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. Exemptions from rules and burn plan requirements include training conducted at stationary fire training structures.
- *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 federal attainment status designations pertaining to the SJVAB are summarized in Table AQ-2. The SJVAB is currently designated as a nonattainment area with respect to the state $O_3$, $PM_{10}$, and $PM_{2.5}$ standards. The SJVAB is designated nonattainment for the federal 8-hour $O_3$ 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 2020).

## AMBIENT AIR QUALITY

Air pollutant concentrations were measured at two monitoring stations in Fresno County. The Fresno-Drummond Street (4706 East Drummond Avenue) monitoring station and Fresno-Hamilton and Winery (Hamilton and Winery) monitoring station 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. The monitoring stations provide ambient concentrations of $O_3$, $NO_2$, $PM_{10}$, and $PM_{2.5}$. Ambient monitoring data was obtained for the last 3 years of available measurement data (i.e., 2017 through 2019) and are summarized in Table AQ-3. As depicted, the state $PM_{10}$ standards, federal $PM_{2.5}$ standards, and state/federal $O_3$ standards were exceeded during the past 3 years.

**Table AQ-2. SJVAB Attainment Status Designations**

| Pollutant | Federal Designation | State Designation |
|---|---|---|
| Ozone, 1 hour | No Federal 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 2020

**Table AQ-3. Summary of Ambient Air Quality Monitoring Data**

| | 2017 | 2018 | 2019 |
|---|---|---|---|
| Ozone[1] | | | |
| Maximum concentration (1-hour/8-hour average) | 0.125/0.104 | 0.119/0.097 | 0.099/0.080 |
| Number of days state 1-hour standard exceeded | 8 | 6 | 1 |
| Number of days state/national 8-hour standard exceeded | 31/29 | 34/32 | 11/10 |
| Nitrogen Dioxide ($NO_2$)[1] | | | |
| Maximum concentration (1-hour average) | 64.7 | 75.9 | 42.3 |
| Annual average | NA | 13 | NA |
| Number of days state/national standard exceeded | 0/0 | 0/0 | 0/0 |
| Suspended Particulate Matter ($PM_{10}$)[1] | | | |
| Maximum concentration (state/national) | 120.5/115.6 | 154.8/152.2 | 181.3/175.6 |
| Number of days state standard exceeded (measured/calculated[3]) | 17/112 | 19/116 | 13/78 |
| Number of days national standard exceeded (measured/calculated[3]) | 0/0 | 0/0 | 1/6 |
| Suspended Particulate Matter ($PM_{2.5}$)[2] | | | |
| Maximum concentration (state/national) | 88.3/88.3 | 89.8/89.8 | 44.7/44.7 |
| Annual Average (state/national) | 15.0/15.0 | NA/17.1 | NA/11.2 |
| Number of days national standard exceeded | 9 | 11 | 3 |

NA = not available

1. Ambient $O_3$, $NO_2$, and $PM_{10}$ data were obtained from the Fresno-Drummond Street (4706 East Drummond Avenue) monitoring station.

2. Ambient $PM_{2.5}$ data were obtained from the Fresno-Hamilton and Winery (Hamilton and Winery) monitoring station.

3. Measured days are those days that an actual measurement was greater than the standard. Calculated days are the estimated number of days that 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, daycare centers, convalescent homes, and hospitals are examples of sensitive land uses.

Nearby existing land uses consist predominantly of residential and agriculture. The nearest sensitive land uses located in the vicinity of the proposed project site include residential dwellings, which are located adjacent to the northern, southern, and western property boundaries. Agricultural land use is located across Temperance Ave, approximately 40 feet east of the eastern property boundary.

## IMPACTS & MITIGATION MEASURES

### METHODOLOGY

*Short-term Impacts*

Short-term construction emissions associated with the proposed project were calculated using the California Emissions Estimator Model (CalEEMod), version 2020.4.0. Emissions were quantified for demolition, site preparation, grading, building construction, paving, and architectural coating. Detailed construction information, including construction schedule and equipment requirements, have not been identified for the proposed project. Default construction schedule and equipment assumptions contained in the CalEEMod were, therefore, relied upon for the calculation of construction-generated emissions. Due to anticipated reductions in future fleet-average emission rates, emissions for future conditions would likely be less. Modeling assumptions and output files are included in Appendix A.

*Long-term Impacts*

Long-term operational emissions of criteria air pollutants associated with the proposed project were calculated using the CalEEMod. Emissions modeling included quantification of emissions associated with area sources, energy use, and mobile sources. Area sources included the use of architectural coatings and landscape maintenance activities. Energy use included emissions associated with natural gas and electricity use. Trip-generation rates for the proposed land use were derived from the *Draft Traffic Impact Analysis Report* prepared for the proposed project (JBL 2021). Mobile-source emissions were conservatively based on the default fleet distribution assumptions contained in the model and include mobile-source emission adjustments to account for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One. The initial operation of the project is anticipated to begin in 2024. Due to anticipated reductions in future fleet-average mobile-source and energy emission rates, emissions for post-year 2024 conditions would likely be less. Exposure to localized pollutant concentrations, including fugitive dust, mobile-source CO, and odors were qualitatively assessed. Modeling assumptions and output files are included in Appendix A of this report.

### THRESHOLDS OF SIGNIFICANCE

In accordance with Appendix G of the California Environmental Quality Act (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, TAC, 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/year of CO, 10 tons/year of ROG or $NO_X$, 27 tons/year of $SO_X$, or 15 tons/year 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 tons/year of CO, 10 tons/year of ROG or $NO_X$, 27 tons/year of $SO_X$, or 15 tons/year 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 $O_3$, $PM_{2.5}$, and $PM_{10}$, if project-generated emissions of $O_3$ 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 TACs would be considered significant if the probability of contracting cancer for the Maximally Exposed Individual (i.e., maximum individual risk) would exceed 20 in one million or would result in a Hazard Index equal or 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 project would also be considered to result in a significant contribution to localized ambient air quality if on-site emissions of 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 AQ-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. Therefore, projects 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 the 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 of significance. 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. Therefore, 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 located in the City of Fresno, which is within the SJVAB. The SJVAB is designated as a nonattainment area with respect to the state $O_3$, $PM_{10}$, and $PM_{2.5}$ standards; and the national 8-hour $O_3$ and $PM_{2.5}$ standards. Potential air quality impacts associated with the proposed project could occur during project construction or operation. 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 phase. Construction-generated emissions are of temporary duration, lasting only as long as construction activities occur, but have the potential to cause a significant air quality impact. The construction of the proposed project would result in the temporary generation of emissions associated with motor vehicle exhaust from construction equipment and worker trips; as well as, the movement of construction equipment on unpaved surfaces.

Estimated annual construction-generated emissions are summarized in Table AQ-4. As noted in Table AQ-4, construction of the proposed project would generate maximum annual emissions of approximately 0.74 tons/year of ROG, 2.63 tons/year of $NO_x$, 2.50 tons/year of CO, less than 0.01 tons/year of $SO_2$, 0.37 tons/year of $PM_{10}$, and 0.23 tons/year of $PM_{2.5}$. Estimated construction-generated annual emissions would not exceed the SJVAPCD's significance thresholds of 10 tons/year of ROG, 10 tons/year of $NO_x$, 100 tons/year of CO, 27 tons/year of $SO_x$,15 tons/year of $PM_{10}$, or 15 tons/year of $PM_{2.5}$.

Construction of the proposed project would generate maximum daily on-site emissions of approximately 5.12 pounds/day of ROG, 17.43 pounds/day of $NO_x$, 17.68 pounds/day of CO, 0.03 pounds/day of $SO_2$, 2.17 pounds/day of $PM_{10}$, and 1.38 pounds/day of $PM_{2.5}$. Estimated construction-generated daily on-site emissions would not exceed the SJVAPCD's significance thresholds of 100 pounds/day of ROG, 100 pounds/day of $NO_x$, 100 pounds/day of CO, 100 pounds/day of $SO_x$, 100 pounds/day of $PM_{10}$, or 100 pounds/day of $PM_{2.5}$.

**Table AQ-4. Annual and Daily Construction Emissions without Mitigation**

| Year | ROG | $NO_x$ | CO | $SO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|
| | tons per year | | | | | |
| 2022 | 0.28 | 2.63 | 2.50 | 0.00 | 0.37 | 0.23 |
| 2023 | 0.74 | 0.86 | 1.03 | 0.00 | 0.06 | 0.04 |
| Maximum | 0.74 | 2.63 | 2.50 | 0.00 | 0.37 | 0.23 |
| SJVAPCD Significance Thresholds | 10 | 10 | 100 | 27 | 15 | 15 |
| Exceeds Significance Thresholds? | No | No | No | No | No | No |
| Daily Emissions (lbs/day) | 5.12 | 17.43 | 17.68 | 0.03 | 2.17 | 1.38 |
| SJVAPCD Significance Thresholds (lbs/day) | 100 | 100 | 100 | 100 | 100 | 100 |
| Exceeds Significance Thresholds? | No | No | No | No | No | No |

lbs/day = pounds per day
Refer to Appendix A for modeling assumptions and results.

Short-term construction of the proposed project would not result in a significant impact on regional or local air quality conditions. Given that project-generated emissions would not exceed applicable SJVAPCD significance thresholds, this impact would be considered less than significant.

Long-term Operational Emissions

Estimated annual operational emissions for the anticipated opening year (year 2024) of the proposed project are summarized in Table AQ-5. As depicted, the proposed project would result in annual operational emissions of approximately 0.75 tons/year of ROG, 0.87 tons/year of $NO_X$, 4.54 tons/year of CO, 0.01 tons/year of $SO_2$, 1.08 tons/year of $PM_{10}$, and 0.30 tons/year of $PM_{2.5}$. Estimated operational-generated annual emissions would not exceed the SJVAPCD's significance thresholds of 10 tons/year of ROG, 10 tons/year of $NO_x$, 100 tons/year of CO, 27 tons/year of $SO_x$,15 tons/year of $PM_{10}$, or 15 tons/year of $PM_{2.5}$.

Operation of the proposed project would generate maximum daily on-site emissions of approximately 8.29 pounds/day of ROG, 9.68 pounds/day of $NO_x$, 50.46 pounds/day of CO, 0.12 pounds/day of $SO_2$, 11.95 pounds/day of $PM_{10}$, and 3.31 pounds/day of $PM_{2.5}$. Estimated operational-generated daily on-site emissions would not exceed the SJVAPCD's significance thresholds of 100 pounds/day of ROG, 100 pounds/day of $NO_x$, 100 pounds/day of CO, 100 pounds/day of $SO_x$, 100 pounds/day of $PM_{10}$, or 100 pounds/day of $PM_{2.5}$.

**Table AQ-5. Annual and Daily Operational Emissions without Mitigation**

| Category | ROG | $NO_x$ | CO | $SO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|
| | tons per year | | | | | |
| Area | 0.27 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Energy | 0.01 | 0.07 | 0.06 | 0.00 | 0.01 | 0.01 |
| Mobile | 0.47 | 0.80 | 4.48 | 0.01 | 1.07 | 0.29 |
| Total | 0.75 | 0.87 | 4.54 | 0.01 | 1.08 | 0.30 |
| SJVAPCD Significance Thresholds | 10 | 10 | 100 | 27 | 15 | 15 |
| Exceeds Significance Thresholds? | No | No | No | No | No | No |
| Daily Emissions (lbs/day)[1] | 8.29 | 9.68 | 50.46 | 0.12 | 11.95 | 3.31 |
| SJVAPCD Significance Thresholds (lbs/day) | 100 | 100 | 100 | 100 | 100 | 100 |
| Exceeds Significance Thresholds? | No | No | No | No | No | No |

lbs/day = pounds per day
1. Assumes that the school operates for 180 days per year.
Includes mobile source emission adjustments to account for SAFE Vehicles Rule Part One. Assumes that the school operates for 180 days per year.
Refer to Appendix A for modeling assumptions and results.

The long-term operation of the proposed project would not result in a significant impact on regional or local air quality conditions. Operational emissions would be projected to decline in future years, with improvements in fuel consumption emissions standards. 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 the proposed land use would consist predominantly of light-duty vehicles. As a result, actual mobile source emissions would likely be less than estimated. Operational emissions would not exceed applicable SJVAPCD significance thresholds, 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 dwellings. The nearest residential dwellings are located adjacent to the northern, southern, and western property boundaries. Long-term operational and short-term construction activities and emission sources that could adversely impact the nearest sensitive receptors are discussed, as follows:

*Long-term Operation*

*Localized Mobile-Source CO Emissions*

CO is the primary criteria air pollutant of local concern associated with the proposed project. Under specific meteorological and operational conditions, such as areas of heavily congested vehicle traffic, CO concentrations may reach unhealthy levels. If inhaled, CO can be adsorbed easily by the bloodstream and 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. The 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 (LOS). Localized CO concentrations associated with the proposed project would be considered less-than-significant if: (1) traffic generated by the proposed project would not result in deterioration of a signalized intersection to LOS E or LOS F; or (2) the project would not contribute additional traffic to a signalized intersection that already operates at LOS E or LOS F.

There are no nearby signalized intersections in the project area. 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.

*Toxic Air Contaminants*

Implementation of the proposed project would not result in the long-term operation of any major onsite stationary sources of TACs, nor would project implementation result in a significant increase in diesel-fueled vehicles traveling along area roadways. No major permitted stationary sources of TACs were identified in the project vicinity that would result in increased exposure of students and employees to TACs (refer to Appendix B). For these reasons, long-term increases in exposure to TACs 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, the risk of exposure to asbestos during construction would be considered less than significant.

*Asbestos-Containing Materials*

Demolition activities can have potential negative air quality impacts, including issues surrounding proper handling, demolition, and disposal of asbestos-containing material (ACM). Asbestos-containing materials could be encountered during the demolition of existing buildings, particularly older structures constructed prior to 1970. Asbestos can also be found in various building products, including (but not limited to) utility pipes/pipelines (transite pipes or insulation on pipes). If a project will involve the disturbance or potential disturbance of ACM, various regulatory requirements may apply, including the requirements stipulated in the Title 40 Code of Federal Regulations (CFR) Part 61, Subpart M-Asbestos NESHAP. These requirements include but are not limited to 1) notification, within at least 10 business days of activities commencing, to the APCD, 2) an asbestos survey conducted by a Certified Asbestos Consultant, and 3) applicable removal and disposal requirements of identified ACM. The proposed project would include the demolition of an existing building that is known to have ACM. With the compliance of SJVAPCD Rule 4002 (NESHAP) and the Asbestos Program (A Certified Asbestos Consultant will need to perform an asbestos survey prior to the demolition of a regulated facility. Following the completion of an asbestos survey submit the asbestos survey, Asbestos Notification, Demolition Permit Release, and the proper fees to the District 10 working days prior to the removal of

Regulated Asbestos Containing Material and the demolition when no asbestos is present.), this impact would be considered less than significant.

*Lead-Coated Materials*

Demolition of structures coated with lead-based paint can have potential negative air quality impacts and may adversely affect the health of nearby individuals. Lead-based paints could be encountered during the demolition of existing buildings, particularly older structures constructed prior to 1978. Improper demolition can result in the release of lead-containing particles from the site. Sandblasting or removal of paint by heating with a heat gun can result in significant emissions of lead. In such instances, proper abatement of lead before demolition of these structures must be performed in order to prevent the release of lead from the site. Federal and State lead regulations, including the Lead in Construction Standard (29 CFR 1926.62) and California Code of Regulations (CCR) Title 8, Section 1532.1, Lead, regulate disturbance of lead-containing materials during construction, demolition, and maintenance-related activities. The proposed project would include the demolition of an existing building that is known to have lead-coated material. With the compliance of 29 CFR 1926.62 and CCR Title 8, Section 1532.1, this impact would be considered less than significant.

*Toxic Air Contaminants (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 construction activities. Health-related risks associated with diesel exhaust emissions are primarily associated with long-term exposure and associated risk of contracting cancer. The use of diesel-powered construction equipment, however, would be temporary and episodic and would occur over a relatively large area. 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. For these reasons, this impact would be considered less than significant.

*Localized PM Concentrations*

Fugitive dust emissions would be primarily associated with site preparation and grading, and vehicle travel on unpaved and paved surfaces. On-site off-road equipment and trucks would also result in short-term emissions of DPM, 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 would be considered to have a potentially significant impact.

Mitigation Measure AQ-1: The following measures shall be implemented to reduce potential exposure of nearby sensitive receptors to localized pollutant concentrations of fugitive dust associated with project construction:

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. Heavy-duty, off-road diesel-fueled equipment (50 horsepower, or greater) 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.

3. Heavy-duty, off-road diesel-fueled equipment (50 horsepower, or greater) shall be fitted with diesel particulate filters, per manufacturer's recommendations, or shall meet at minimum Tier 3 emissions standards. To the extent locally available, tier 4 should be used.
4. Signs shall be posted at the project site construction entrance to remind drivers and operators of the state's 5-minute idling limit.
5. To the extent available, replace fossil-fueled equipment with alternatively-fueled (e.g., natural gas) or electrically-driven equivalents.
6. Construction truck trips shall be scheduled, to the extent feasible, to occur during non-peak hours.
7. The burning of vegetative material shall be prohibited.
8. 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. Within urban areas, trackout shall be immediately removed when it extends 50 or more feet from the site and at the end of each workday.
    i. An owner/operator of any site with 150 or more vehicle trips per day, or 20 or more vehicle trips per day by vehicles with three or more axles shall implement measures to prevent carryout and trackout.
    j. On-road vehicle speeds on unpaved surfaces of the project site shall be limited to 15 mph.
    k. 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.
    l. Install wheel washers for all exiting trucks, or wash off all trucks and equipment leaving the site.
    m. Install wind breaks at windward side(s) of construction areas.
    n. 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).
    o. Limit area subject to excavation, grading, and other construction activity at any one time.

Significance After Mitigation

Implementation of Mitigation Measure AQ-1 would include measures to ensure compliance with applicable regulatory requirements. The measures would reduce construction-generated emissions that could contribute to increased localized pollutant concentrations at nearby sensitive receptors. Some measures include requirements that heavy-duty off-road equipment is fitted with diesel-particulate filters or meets Tier 3 emissions standards. With mitigation, this impact would be considered less than significant.

*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 from the generation of odors during project construction. The occurrence and severity of odor impacts depend 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. Land uses commonly considered to be potential sources of offensive odorous emissions include agriculture (e.g., farming and livestock), wastewater treatment plants, food processing plants, chemical plants, composting facilities, refineries, landfills, dairies, and fiberglass molding facilities.

The 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. 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 into the atmosphere by biological processes occurring in anaerobic environments. $CH_4$ 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 $CH_4$ into the atmosphere. Natural sources of $CH_4$ include wetlands, gas hydrates, permafrost, termites, oceans, freshwater bodies, non-wetland soils, and other sources such as wildfires. $CH_4$ 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, perfluoroethane, perfluoropropane, perfluorobutane, perfluorocyclobutane, perfluoropentane, and perfluorohexane. 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. $NF_3$ 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 AB 32 (Section 38505 Health and Safety Code).

- Sulfur Hexafluoride. Sulfur hexafluoride ($SF_6$) is an inorganic compound that is colorless, odorless, non-toxic, and generally non-flammable. $SF_6$ 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 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) (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 weighs 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 GHG-1 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, $CH_4$ traps over 28-36 times more heat per molecule than $CO_2$ and $N_2O$ absorbs roughly 265-298 times more heat per molecule than $CO_2$. Additional GHG with high GWP include $NF_3$, $SF_6$, PFCs, and black carbon.

**Table GHG-1. Global Warming Potential for Greenhouse Gases**

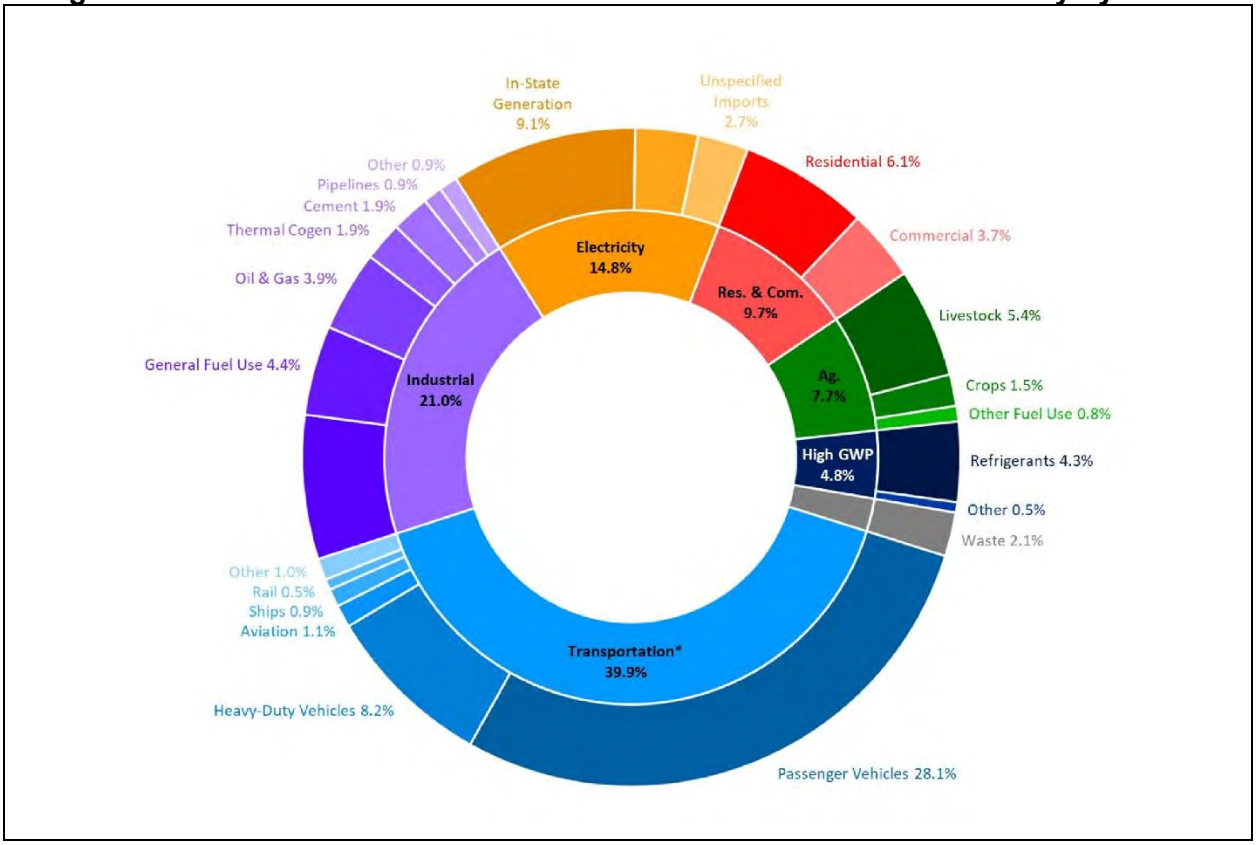
| Greenhouse Gas | Global Warming Potential (100-year) |
|---|---|
| Carbon Dioxide ($CO_2$) | 1 |
| Methane ($CH_4$) | 28-36 |
| Nitrous Dioxide ($N_2O$) | 265-298 |
| Source: EPA 2020 | |

## 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. Worldwide, energy production including the burning of coal, natural gas, and oil for electricity and heat is typically considered the largest single source of global GHG emissions.

In 2018, GHG emissions within California totaled 425 million metric tons of carbon dioxide equivalents ($MMTCO_2e$). Within California, the transportation sector is the largest contributor, accounting for roughly 40 percent of the total state-wide GHG emissions. Emissions associated with the industrial sector are the second-largest contributor, totaling approximately 21 percent. Emissions from in-state electricity generation, imported electricity, agriculture & forestry, residential, and commercial uses constitute the remaining major sources of GHG emissions. In comparison to the year 2017 emissions inventory, overall GHG emissions in California increased by 0.8 $MMTCO_2e$. The State of California GHG emissions inventory for year 2018, by sector, is depicted in Figure GHG-1 (ARB 2021).

**Figure GHG-1. State of California Greenhouse Gases Emissions Inventory by Sector**




This figure breaks out 2018 emissions by sector into an additional level of sub-sector categories.

* The transportation sector represents tailpipe emissions from on-road vehicles and direct emissions from other off-road mobile sources. It does not include emissions from petroleum refineries and oil extraction and production, which are included in the industrial sector.

Source: ARB 2021

*Short-Lived Climate Pollutants*

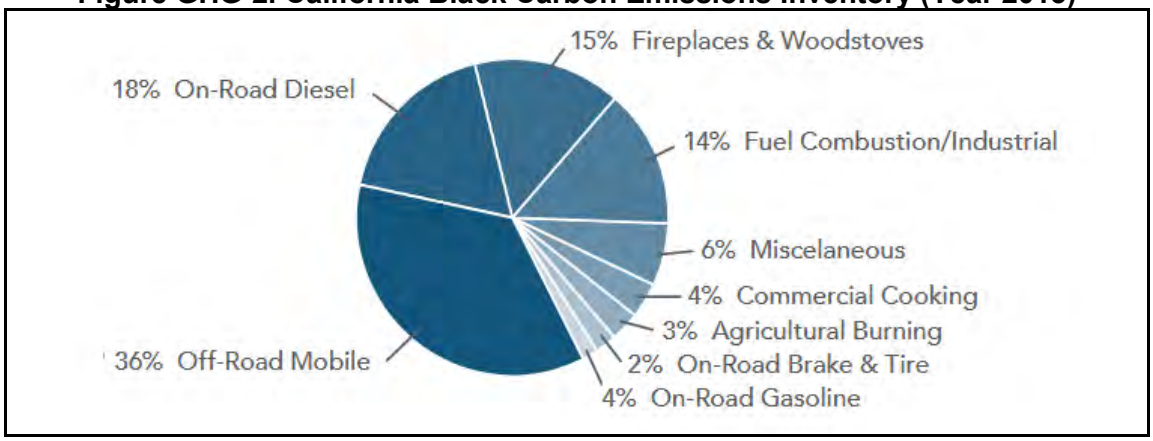
Short-lived climate pollutants (SLCPs), such as black carbon, fluorinated gases, and $CH_4$ also have a dramatic effect on climate change. Though short-lived, these pollutants create a warming influence on the climate that is many times more potent than that of $CO_2$.

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 the 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 is for year 2013 conditions and depicted in Figure GHG-2. 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 2015).

## 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 GHG-2. California Black Carbon Emissions Inventory (Year 2013)**




Source: ARB 2015

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 the 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 the spring and summer months. Earlier snowmelt would also impact the State's energy resources. In 2019, approximately 19 percent of California's electricity came from hydropower (CEC 2020). Early exhaustion of the Sierra snowpack may force electricity producers to switch to more costly or non-renewable forms of electricity generation during the spring and summer months. A changing climate may also impact agricultural crop yields, coastal structures, and biodiversity. As a result, 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 2017a).

## REGULATORY FRAMEWORK

### FEDERAL

*Executive Order 13514*

Executive Order (EO) 13514 is focused on reducing GHGs internally in federal agency missions, programs, and operations. In addition, the EO 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 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 (CAFE) 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 $MMTCO_2e$ 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.

### *Executive Order No. S-3-05*

EO 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 EO established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, to the 1990 level by 2020, and 80 percent below the 1990 level by 2050.

The EO 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 EO, 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 (ARB 2016).

*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 $MMTCO_2e$ will be achieved associated with the implementation of Senate Bill (SB) 375, which is discussed further below.

The initial Scoping Plan was first approved by ARB on December 11, 2008, and is updated every 5 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 (ARB 2014).

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

SB 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 of 20 percent of their supply from renewable sources by 2017. This SB will affect statewide GHG emissions associated with electricity generation. In 2008, Governor Schwarzenegger signed EO 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. EO S-14-08 was later superseded by EO S-21-09 on September 15, 2009. EO S-21-09 directed the ARB to adopt regulations requiring 33 percent of electricity sold in the State to come from renewable energy by 2020. Statute SB X1-2 superseded this EO 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 8 years but can be updated every 4 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 CBC is adopted every 3 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 (BSC 2016).

*Green Building Standards*

In essence, green buildings standards are indistinguishable from any other building standards. Both standards are contained in the CBC 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$CO_2$e by 2020. The green buildings standards were most recently updated in 2016.

*Senate Bill 97*

SB 97 was enacted in 2007. SB 97 required the Office of Planning and Research (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* establishing a path to decrease GHG emissions and displace fossil-based natural gas use. Strategies include avoiding landfill $CH_4$ emissions by reducing the disposal of organics through edible food recovery, composting, in-vessel digestion, and other processes; and recovering $CH_4$ from wastewater treatment facilities, and manure $CH_4$ at dairies, and using the $CH_4$ 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 HFC emissions at national and international levels, in addition to State-level action that includes an incentive program to encourage the use of low-GWP refrigerants, and limitations on the use of high-GWP refrigerants in new refrigeration and air-conditioning equipment (ARB 2017a).

*EMFAC Off-Model Adjustment Factors for Carbon Dioxide ($CO_2$) Emissions to Account for the SAFE Vehicles Rule Part One and the Final SAFE Rule*

On September 27, 2019, the U.S. EPA and the NHTSA published The SAFE Vehicles Part One Rule that revokes California's authority to set its own GHG emissions standards and set zero-emission vehicle mandates in California.

In April 2020, the U.S. EPA and the NHTSA issued the SAFE Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks (Final SAFE Rule) that relaxed federal GHG emissions and CAFE standards.

## 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 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 an 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 AB 32 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 areas.

*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 the quantification of the impacts that project-specific GHG 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 GHG emissions, whether through project design elements or mitigation.

The SJVAPCD's approach is intended to streamline the process of determining if project-specific GHG 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 GHG emissions and would be determined to have a less than significant cumulative impact for GHG emissions. Projects not complying with BPS would require quantification of GHG emissions and demonstration that GHG emissions have been reduced or mitigated by 29 percent, as targeted by ARB's AB 32 Scoping Plan. Furthermore, quantification of GHG 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 BPS.

For stationary source permitting projects, BPS are "the most stringent of the identified alternatives for control of GHG emissions, including the 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, BPS are "any combination of identified GHG emission reduction measures, including project design elements and land use decisions that reduce project-specific GHG emission reductions by at least 29 percent compared with business as usual (BAU)." The SJVAPCD proposes to create a list of all approved BPS 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 emissions were quantified using the CalEEMod computer program based on estimated acreages and building square footage for the proposed project. Other modeling assumptions, including construction equipment requirements, hours of use, worker, and vendor vehicle trips, trip distances, and fleet mix were based on model defaults for the County of Fresno. The SJVAPCD has not provided guidance on what the amortization period for individual projects should be. However, other air districts in California have identified recommended amortization periods for construction activities. For instance, the South Coast Air Quality Management District (SCAQMD) recommends a period of 30 years (SCAQMD 2008). In contrast, the San Luis Obispo County Air Pollution Control District (SLOAPCD) recommends a 50-year period for residential projects and a 25-year period for non-residential or commercial projects (SLOAPCD 2012). To be conservative, the SLOAPCD 25-year amortization period is utilized in this analysis.

*Long-term Impacts*

Long-term operational GHG emissions were calculated using the CalEEMod computer program. Emissions modeling included quantification of emissions associated with area sources, energy use, and mobile sources. Trip-generation rates for the proposed land use were derived from the Draft *Traffic Impact Analysis Report* prepared for the proposed project (JBL 2021). Mobile-source emissions were conservatively based on the default fleet distribution assumptions contained in the model and include mobile-source emission adjustments to account for the Final SAFE Vehicles Rule. Emission modeling files are provided in Appendix A.

### 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 BAU.

The SJVAPCD has not yet adopted BPS 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.

The analysis was compared to a calculated GHG efficiency threshold based on the SB 32 GHG emission reduction goals, which take into consideration the emission reduction strategies outlined in ARB's Scoping Plan. The efficiency threshold was calculated based on ARB's GHG emissions inventory identified in the 2017 Climate Change Scoping Plan Update. Emissions sectors that do not apply to the proposed project (i.e., agriculture, residential, commercial, and industrial) were excluded from the calculation. The total GHG emissions target for the land use sectors applicable to the proposed project were then divided by the projected service population (SP) (i.e., the sum of the population and employment in California) for the future year 2030 conditions. The service population was calculated based on the most current population and employment projections derived from the California Department of Finance Demographic Research Unit and 2017 Climate Change Scoping Plan, respectively (DOF 2021, ARB 2017b). As shown in Table GHG-2, project-generated GHG emissions that would exceed the calculated efficiency threshold of 2.3 $MTCO_2e/SP/year$ would be considered to have a potentially significant impact on the environment that could conflict with GHG-reduction planning efforts. To be conservative, amortized construction-generated GHG emissions were included in the annual operational GHG emissions estimates.

**Table GHG-2. Project-Level GHG Efficiency Threshold Calculation**

| | Year 2030 |
|---|---|
| Land Use Sectors GHG Emissions Target ($CO_2e$) [1] | 183,000,000 |
| Population | 41,860,549 |
| Employment | 23,459,500 |
| Service Population (SP) | 65,320,049 |
| GHG Efficiency Threshold ($MTCO_2e/SP/yr$) | 2.8 |

GHG = Greenhouse gas; $CO_2e$ = Carbon dioxide equivalent; SP = Service population;
$MTCO_2e$ = Metric tons of carbon dioxide equivalent; yr = Year
1. Based on ARB 2017 Climate Scoping Plan Update/SB 32 Scoping Plan Emissions Sector targets. Does not include the agriculture, residential, commercial, and industrial sector. As well as the cap-and-trade program.

## 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?*

Estimated GHG emissions attributable to future development would be primarily associated with increases in $CO_2$ from mobile sources. To a lesser extent, other GHG pollutants, such as $CH_4$ and $N_2O$, would also be generated. 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

Estimated increases in GHG emissions associated with the construction of the proposed project are summarized in Table GHG-3. Based on the modeling conducted, construction-related GHG emissions would total approximately 579.6 $MTCO_2e$. Amortized GHG emissions, when averaged over the conservative assumption of a 25-year project life would total approximately 23.2 $MTCO_2e$/year. Actual emissions may vary, depending on the final construction schedules, equipment required, and activities conducted. Amortized construction-generated GHG emissions are included in the operational GHG emissions impact discussion provided below.

**Table GHG-3. Construction-Generated GHG Emissions without Mitigation**

| Construction Year | GHG Emissions ($MTCO_2e$/Year) |
|---|---|
| 2022 | 416.8 |
| 2023 | 162.8 |
| Construction Total: | 579.6 |
| Amortized Construction Emissions: | 23.2 |

$MTCO_2e$ = Metric tons of carbon dioxide equivalent
Amortized emissions are quantified based on 25-year project life.

### Long-term Greenhouse Gas Emissions

Estimated long-term increases in GHG emissions associated with the proposed project are summarized in Table GHG-4. As depicted, operational GHG emissions for the proposed project, with the inclusion of amortized construction GHGs, would total approximately 1,232.9 $MTCO_2e$/year. A majority of the operational GHG emissions would be associated with energy use and the operation of motor vehicles. Project-generated GHG emissions are projected to decrease in future years due largely to improvements in energy efficiency and vehicle fleet emissions. Based on the modeling conducted an estimated 745 SP (i.e., 700 students and 45 employees) was used to calculate the GHG efficiency. The calculated GHG efficiency for the proposed project, without mitigation, would be approximately 1.7 $MTCO_2e$/SP/yr. The GHG efficiency for the proposed project would not exceed the threshold of 2.8 $MTCO_2e$/SP/yr. For these reasons, this impact would be considered less than significant.

**Table GHG-4. Operational GHG Emissions without Mitigation**

| Emission Source | Emissions ($MTCO_2e$/Year) |
|---|---|
| Area | 0.0 |
| Energy | 115.3 |
| Mobile | 1025.5 |
| Waste | 64.2 |
| Water | 4.6 |
| Total Operational Emissions: | 1209.7 |
| Amortized Construction Emissions: | 23.2 |
| Total with Amortized Construction Emissions: | 1,232.9 |
| Service Population (SP): | 745 |
| $MTCO_2e$/SP: | 1.7 |
| GHG Efficiency Significance Threshold: | 2.8 |
| Exceeds Threshold? | No |

GHG = Greenhouse gas; SP = Service population; $MTCO_2e$ = Metric tons of carbon dioxide equivalent
Includes mobile-source emission adjustments to account for the Final SAFE Vehicles Rule.

*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 the State's GHG-reduction target goals. The proposed project would be designed to meet current building energy-efficiency standards, which include measures to reduce overall energy use, water use, and waste generation. As a result, the proposed project would not conflict with local, regional, or state GHG-reduction planning efforts. This impact would be considered less than significant.

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# APPENDIX 2

## Biological Resources Information

# 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

Fresno 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.

---

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. IPaC only shows species that are regulated by USFWS (see FAQ).
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 |
|---|---|

Fresno Kangaroo Rat Dipodomys nitratoides exilis — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/5150

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

# Birds

| NAME | STATUS |
|---|---|
| Yellow-billed Cuckoo Coccyzus americanus | Threatened |

Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/3911

# Reptiles

| NAME | STATUS |
|---|---|
| Blunt-nosed Leopard Lizard Gambelia silus | Endangered |

Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/625

Giant Garter Snake Thamnophis gigas — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4482

# Amphibians

| NAME | STATUS |
|---|---|
| California Red-legged Frog Rana draytonii | Threatened |

Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2891

California Tiger Salamander Ambystoma californiense — Threatened
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2076

# Fishes

| NAME | STATUS |
| --- | --- |
| Delta Smelt Hypomesus transpacificus<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/321 | Threatened |

# Crustaceans

| NAME | STATUS |
| --- | --- |
| Vernal Pool Fairy Shrimp Branchinecta lynchi<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/498 | 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.

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

THERE ARE NO MIGRATORY BIRDS OF CONSERVATION CONCERN EXPECTED TO OCCUR AT THIS LOCATION.

**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 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

## Wildlife refuges and fish hatcheries

REFUGE AND FISH HATCHERY INFORMATION IS NOT AVAILABLE AT THIS TIME

# 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.

THERE ARE NO KNOWN WETLANDS AT THIS LOCATION.

**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 3

## Energy Impact Assessment

**(Note: Appendices to Appendix 3 are available upon request by contacting Daniel Brannick at daniel@odellplanning.com or (559) 472-7167)**

# ENERGY IMPACT ASSESSMENT

FOR THE PROPOSED

# NEW SOUTHEAST FRESNO ELEMENTARY SCHOOL PROJECT

CITY OF FRESNO, CA

JULY 2021

**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
TEL: 805.226.2727

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APPENDICES

LIST OF COMMON TERMS & ACRONYMS

| | |
|---|---|
| °F | Degrees Fahrenheit |
| AB | Assembly Bill |
| AFV | Alternative Fuel Vehicle |
| APS | Alternative Planning Strategy |
| ARB | California Air Resource Board |
| BSC | Building Standards Commission |
| CAFE | Corporate Average Fuel Economy |
| CalEEMod | California Emissions Estimator Model |
| CBC | California Building Code |
| CEC | California Energy Commission |
| CEQA | California Environmental Quality Act |
| CO2 | Carbon Dioxide |
| CPUC | California Public Utilities Commission |
| EAP | Energy Action Plan |
| EMFAC | Emissions Factor |
| EO | Executive Order |
| EPAct | Energy Policy Act |
| GHG | Greenhouse Gas |
| kBTU | Kilo British Thermal Units |
| kWh | Kilowatt Hour |
| MMBTU | Million British Thermal Units |
| mpg | Miles per Gallon |
| MPO | Metropolitan Planning Organization |
| NHSTA | National Highway Traffic Safety Administration |
| PG&E | Pacific Gas and Electric |
| RPS | Renewables Portfolio Standard |
| RTP | Regional Transportation Plan |
| SAF | State Alternative Fuel |
| SB | Senate Bill |
| SCAQMD | South Coast Air Quality Management District |
| SCS | Sustainable Communities Strategy |
| U.S. DOT | United States Department of Transportation |
| U.S. EPA | United States Environmental Protection Agency |
| VMT | Vehicle Mile Traveled |

# INTRODUCTION

This report provides an analysis of potential energy impacts associated with the proposed New Southeast Fresno Elementary School Project. This report also provides a summary of existing conditions in the project area and the applicable regulatory framework pertaining to energy.

# PROPOSED PROJECT

The Sanger Unified School District (District) is proposing to undertake the New Southeast Fresno Elementary School Project (project).

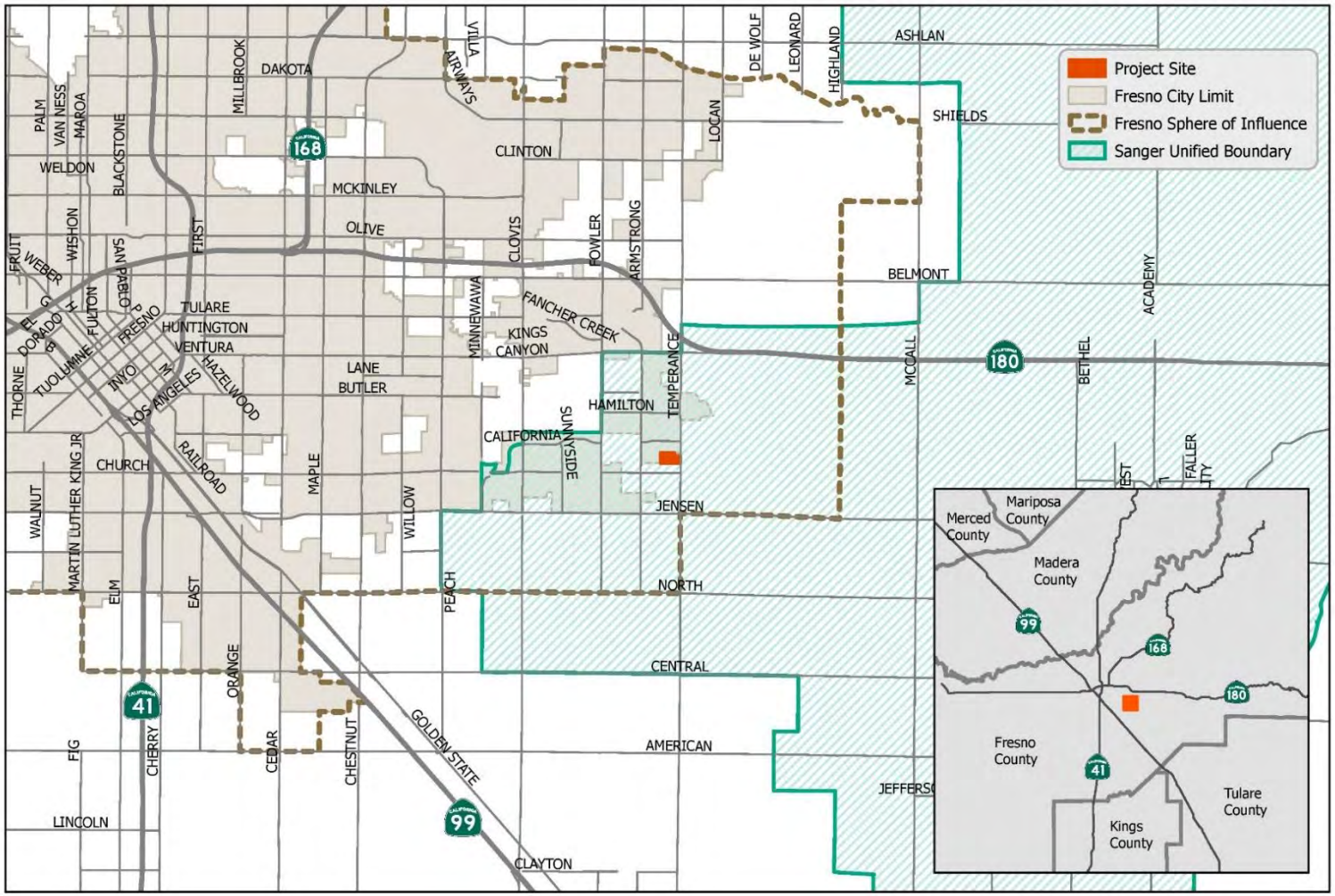
The project site encompasses 17.93 acres located on the west side of Temperance Avenue approximately 700 feet north of Church Avenue in an unincorporated portion of Fresno County, California (APNs 316-160-46 and 316-160-72). The site is immediately adjacent to the City of Fresno's city limits and is within the Fresno Sphere of Influence. The location of the project site is displayed in Figures 1 and 2.

The District is proposing to develop the New Southeast Fresno Elementary School Project to serve the anticipated student enrollment growth generated by new urban development within southeast Fresno. The proposed elementary school will be designed to provide capacity for approximately 700 students in kindergarten through sixth grades. This campus will have approximately 45 employees (including administrators, faculty, and support staff). Facilities planned as part of the project include administrative offices, classrooms, a multi-purpose building, sport fields, physical education facilities, and parking areas (refer to Figure 3). Instructional activities at the elementary school will be in regular session on weekdays from late August to early June, with additional special events and classes during evenings, on weekends, and during the summer recess.

The project includes the annexation of the site to the City of Fresno. It is anticipated that the project will be served by the City of Fresno's water and sewer systems.

Construction of the project will likely begin within the next five years to coincide with planned residential development in the area and funding availability.

## Figure 1. Project Location




**Project Location** **Figure 1**

New Southeast Fresno Elementary School Project
Sanger Unified School District

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

**Figure 2. Project Site**

**Figure 3. Project Site Plan**

# ENERGY FUNDAMENTALS

Energy use is typically associated with transportation, construction, and the operation of land uses. Transportation energy use is generally categorized by direct and indirect energy. Direct energy relates to energy consumption by vehicle propulsion. Indirect energy relates to the long-term indirect energy consumption of equipment, such as maintenance activities. Energy is also consumed by construction and routine operation and maintenance of land use. Construction energy relates to a direct one-time energy expenditure primarily associated with the consumption of fuel used to operate construction equipment. Energy-related to land use is normally associated with direct energy consumption for heating, ventilation, and air conditioning of buildings.

# EXISTING SETTING

The project is located in the City of Fresno. The project area has a semi-arid climate with annual average precipitation of approximately 11 inches. Temperatures in the project area range from an average minimum of approximately 37 degrees Fahrenheit (°F), in December, to an average maximum of 98°F, in July (WRCC 2021).

## Energy Resources

Energy sources for the City of Fresno are primarily served by Pacific Gas & Electric (PG&E). Energy resources consist largely of natural gas, nuclear, fossil fuels, hydropower, solar, and wind. The primary use of energy sources is for electricity to operate buildings.

### *Electricity*

Electric services in the City of Fresno are provided by PG&E.

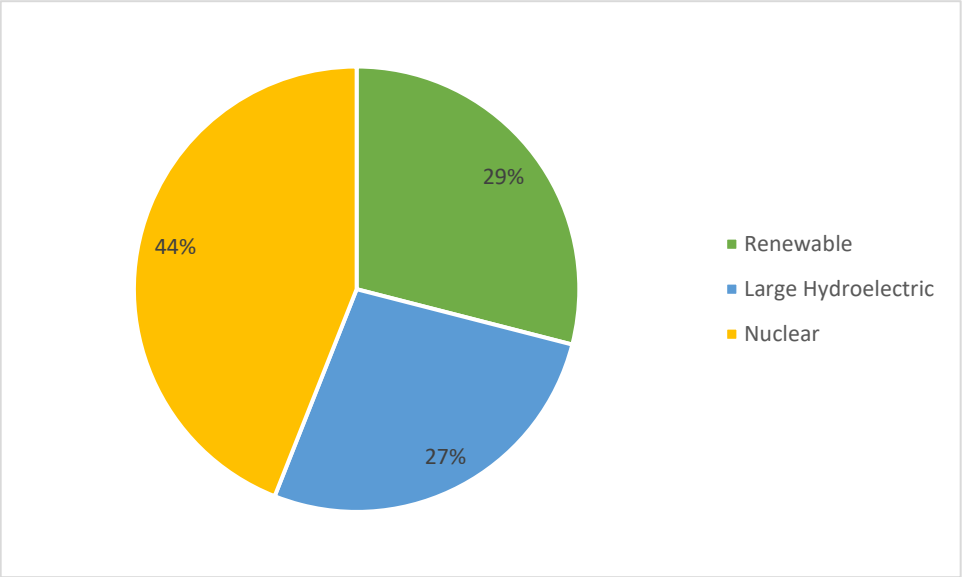
#### Pacific Gas & Electric

The breakdown of PG&E's power mix is shown in Figure 4. As shown, PG&E's energy generation was supplied from approximately 29% of renewable energy sources (i.e., biomass and waste, geothermal, small hydroelectric, solar, and wind), 27% of large hydroelectric sources, and 44% of nuclear sources. Participation in PG&E as an electricity provider is mandatory.

### *Natural Gas*

Natural gas services in the City of Fresno are provided by PG&E. PG&E's natural gas system encompasses approximately 70,000 square miles in Northern and Central California. Natural gas throughput provided by PG&E totals approximately 2.6 billion cubic feet per day (PG&E 2020b).

**Figure 4. Pacific Gas & Electric 2019 Power Content Label**




Source: PG&E 2020a

# Regulatory Framework

## Federal

### Regulations for Greenhouse Gas Emissions from Passenger Cars and Trucks and Corporate Average Fuel Economy Standards

In October 2012, the United States Environmental Protection Agency (U.S. EPA) and National Highway Traffic Safety Administration (NHSTA), on behalf of the United States Department of Transportation (U.S. DOT), issued final rules to further reduce greenhouse gas (GHG) emissions and improve corporate average fuel economy (CAFE) standards for light-duty vehicles for model years 2017 and beyond. NHTSA's CAFE standards have been enacted under the Energy Policy and Conservation Act since 1978. This national program requires automobile manufacturers to build a single light-duty national fleet that meets all requirements under both federal programs and the standards of California and other states. This program would increase fuel economy to the equivalent of 54.5 miles per gallon (mpg) limiting vehicle emissions to 163 grams of carbon dioxide ($CO_2$) per mile for the fleet of cars and light-duty trucks by the model year 2025.

In January 2017, U.S. EPA Administrator Gina McCarthy signed a Final Determination to maintain the current GHG emissions standards for the model year 2022-2025 vehicles. However, on March 15, 2017, U.S. EPA Administrator Scott Pruitt and U.S. DOT Secretary Elaine Chao announced that U.S. EPA intends to reconsider the Final Determination. On April 2, 2018, U.S. EPA Administrator Scott Pruitt officially withdrew the January 2017 Final Determination, citing information that suggests that these current standards may be too stringent due to changes in key assumptions since the January 2017 Determination. According to the U.S. EPA, these key assumptions include gasoline prices and overly optimistic consumer acceptance of advanced technology vehicles. The April 2, 2018 notice is not U.S. EPA's final agency action. The U.S. EPA intends to initiate rulemaking to adopt new standards. Until that rulemaking has been completed, the current standards remain in effect. (U.S. EPA 2017, U.S. EPA 2018).

### Energy Policy and Conservation Act

The Energy Policy and Conservation Act of 1975 sought to ensure that all vehicles sold in the United States would meet certain fuel economy goals. Through this Act, Congress established the first fuel economy standards for on-road motor vehicles in the U.S. Pursuant to the Act, the NHSTA, which is part of the U.S. DOT, is responsible for establishing additional vehicle standards and for revising existing standards. Since 1990, the

fuel economy standard for new passenger cars has been 27.5 mpg. Since 1996, the fuel economy standard for new light trucks (gross vehicle weight of 8,500 pounds or less) has been 20.7 mpg. Heavy-duty vehicles (i.e., vehicles and trucks over 8,500 pounds gross vehicle weight) are not currently subject to fuel economy standards. Compliance with federal fuel economy standards is determined based on each manufacturer's average fuel economy for the portion of its vehicles produced for sale in the U.S. The CAFE program, administered by U.S. EPA, was created to determine vehicle manufacturers' compliance with the fuel economy standards. U.S. EPA calculates a CAFE value for each manufacturer based on city and highway fuel economy test results and vehicle sales. Based on the information generated under the CAFE program, the U.S. DOT is authorized to assess penalties for noncompliance.

### Energy Policy Act of 1992

The Energy Policy Act of 1992 (EPAct) was passed to reduce the country's dependence on foreign petroleum and improve air quality. EPAct includes several parts intended to build an inventory of alternative fuel vehicles (AFVs) in large, centrally fueled fleets in metropolitan areas. EPAct requires certain federal, state, and local government and private fleets to purchase a percentage of light-duty AFVs capable of running on alternative fuels each year. In addition, financial incentives are included in EPAct. Federal tax deductions will be allowed for businesses and individuals to cover the incremental cost of AFVs. States are also required by the act to consider a variety of incentive programs to help promote AFVs.

### Energy Policy Act of 2005

The Energy Policy Act of 2005 was signed into law on August 8, 2005. Generally, the Act provides for renewed and expanded tax credits for electricity generated by qualified energy sources, such as landfill gas; provides bond financing, tax incentives, grants, and loan guarantees for clean renewable energy and rural community electrification; and establishes a federal purchase requirement for renewable energy.

## State

### Warren-Alquist Act

The 1975 Warren-Alquist Act established the California Energy Resources Conservation and Development Commission, now known as the California Energy Commission (CEC). The Act established a state policy to reduce wasteful, uneconomical, and unnecessary uses of energy by employing a range of measures. The California Public Utilities Commission (CPUC) regulates privately-owned utilities in the energy, rail, telecommunications, and water fields.

### Assembly Bill 32: Climate Change Scoping Plan and Update

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 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 reach the 2050 goals (ARB 2014). The most recent update released by ARB is the 2017 Climate Change Scoping Plan, which was released in November 2017. The measures identified in the 2017 Climate Change Scoping Plan have the co-benefit of increasing energy efficiency and reducing California's dependency on fossil fuels.

## Assembly Bill 1007: State Alternative Fuels Plan

AB 1007 (Chapter 371, Statues of 2005) required CEC to prepare a state plan to increase the use of alternative fuels in California. CEC prepared the State Alternative Fuels (SAF) Plan in partnership with ARB and in consultation with other state, federal, and local agencies. The SAF Plan presents strategies and actions California must take to increase the use of alternative non-petroleum fuels in a manner that minimizes the costs to California and maximizes the economic benefits of in-state production. The SAF Plan assessed various alternative fuels and developed fuel portfolios to meet California's goals to reduce petroleum consumption, increase alternative fuel use, reduce GHG emissions, and increase in-state production of biofuels without causing significant degradation of public health and environmental quality.

## Assembly Bill 2076: Reducing Dependence on Petroleum

Pursuant to Assembly Bill (AB) 2076 (Chapter 936, Statutes of 2000), CEC and the California Air Resource Board (ARB) prepared and adopted a joint agency report in 2003, Reducing California's Petroleum Dependence. Included in this report are recommendations to increase the use of alternative fuels to 20 percent of on-road transportation fuel use by 2020 and 30 percent by 2030, significantly increase the efficiency of motor vehicles, and reduce per capita vehicle miles traveled (VMT) (ARB 2003). Further, in response to the CEC's 2003 and 2005 Integrated Energy Policy Reports, Governor Davis directed CEC to take the lead in developing a long-term plan to increase alternative fuel use. A performance-based goal of AB 2076 was to reduce petroleum demand to 15 percent below 2003 demand by 2020.

## Senate Bill 350: Clean Energy and Pollution Prevention Reduction Act of 2015

The Clean Energy and Pollution Reduction Act of 2015 (SB 350) requires the amount of electricity generated and sold to retail customers per year from eligible renewable energy resources to be increased to 50 percent by December 31, 2030. This act also requires a doubling of the energy efficiency savings in electricity and natural gas for retail customers through energy efficiency and conservation by December 31, 2030.

## 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 (RTP). 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.

## Senate Bill 1078: California Renewables Portfolio Standard Program

Senate Bill (SB) 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 of 20 percent of their supply from renewable sources by 2017. This SB will affect statewide GHG emissions associated with electricity generation. In 2008, Governor Schwarzenegger signed Executive Order (EO) S-14-08, which set the Renewables Portfolio Standard (RPS) 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. EO S-14-08 was later superseded by EO S-21-09 on September 15, 2009. EO S-21-09 directed the ARB to adopt regulations requiring 33 percent of electricity sold in the State to come from renewable energy by 2020. Statute SB X1-2 superseded this EO 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.

## Senate Bill 32 and Assembly Bill 197 of 2016

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. Achievement of these goals will have the co-benefit of increasing energy efficiency and reducing California's dependency on fossil fuels.

## Executive Order S-06-06

EO S-06-06, signed on April 25, 2006, establishes targets for the use and production of biofuels and biopower, and directs state agencies to work together to advance biomass programs in California while providing environmental protection and mitigation. The EO establishes the following target to increase the production and use of bioenergy, including ethanol and biodiesel fuels made from renewable resources: produce a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050. The EO also calls for the State to meet a target for use of biomass electricity. The 2011 Bioenergy Action Plan identifies those barriers and recommends actions to address them so that the State can meet its clean energy, waste reduction, and climate protection goals. The 2012 Bioenergy Action Plan updates the 2011 plan and provides a more detailed action plan to achieve the following goals:

- increase environmentally- and economically-sustainable energy production from organic waste;
- encourage the development of diverse bioenergy technologies that increase local electricity generation, combined heat and power facilities, renewable natural gas, and renewable liquid fuels for transportation and fuel cell applications;
- create jobs and stimulate economic development, especially in rural regions of the state; and
- reduce fire danger, improve air and water quality, and reduce waste.

In 2019, 2.87 percent of the total electrical system power in California was derived from biomass (CEC 2020).

## Executive Order B-48-18: Zero-Emission Vehicles

In January 2018, Governor Brown signed EO B-48-18 which required all State entities to work with the private sector to put at least 5-million zero-emission vehicles on the road by 2030, as well as install 200 hydrogen fueling stations and 250,000 zero-emissions chargers by 2025. In addition, State entities are also required to continue to partner with local and regional governments to streamline the installation of zero-emission vehicle infrastructure. Additionally, all State entities are to support and recommend policies and actions to expand infrastructure in homes, through the Low-Carbon Fuel Standard.

## Energy Action Plan

The first Energy Action Plan (EAP) emerged in 2003 from a crisis atmosphere in California's energy markets. The State's three major energy policy agencies (CEC, CPUC, and the Consumer Power and Conservation Financing Authority [established under deregulation and now defunct]) came together to develop one high-level, coherent approach to meeting California's electricity and natural gas needs. It was the first time that energy policy agencies formally collaborated to define a common vision and set of strategies to address California's future energy needs and emphasize the importance of the impacts of energy policy on the California environment.

In the October 2005 EAP II, CEC and CPUC updated their energy policy vision by adding some important dimensions to the policy areas included in the original EAP, such as the emerging importance of climate change, transportation-related energy issues, and research and development activities. The CEC adopted an update to the EAP II in February 2008 that supplements the earlier EAPs and examines the State's ongoing actions in the context of global climate change.

## 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 CBC 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, are contained in the CBC, and regulate the construction of new buildings and improvements. 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.

The green buildings standards were updated in May 2018. Referred to as the 2019 Building Energy Efficiency Standards, these updates focus on four key areas: smart residential photovoltaic systems, updated thermal envelope standards (preventing heat transfer from the interior to the exterior and vice versa), residential and nonresidential ventilation requirements, and nonresidential lighting requirements. Under the newly adopted standards, nonresidential buildings will use about 30 percent less energy due mainly to lighting upgrades (CEC 2018).

### Advanced Clean Cars Program

In January 2012, ARB approved the Advanced Clean Cars program which combines the control of GHG emissions and criteria air pollutants, as well as requirements for greater numbers of zero-emission vehicles, into a single package of standards for vehicle model years 2017 through 2025. The new rules strengthen the GHG standard for 2017 models and beyond. This will be achieved through existing technologies, the use of stronger and lighter materials, and more efficient drivetrains and engines. The program's zero-emission vehicle regulation requires a battery, fuel cell, and/or plug-in hybrid electric vehicles to account for up to 15 percent of California's new vehicle sales by 2025. The program also includes a clean fuels outlet regulation designed to support the commercialization of zero-emission hydrogen fuel cell vehicles planned by vehicle manufacturers by 2015 by requiring increased numbers of hydrogen fueling stations throughout the state. The number of stations will grow as vehicle manufacturers sell more fuel cell vehicles. By 2025, when the rules will be fully implemented, the statewide fleet of new cars and light trucks will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions than the statewide fleet in 2016 (ARB 2016).

## Local

### City of Fresno General Plan

The City of Fresno General Plan is a comprehensive, long-term framework for the protection of agricultural, natural, and cultural resources and for development in the city (City of Fresno 2014). Designed to meet State general plan requirements, it outlines policies, standards, and programs and sets out plan proposals to guide day-to-day decisions concerning the City of Fresno's future. Applicable energy policies include, but are not limited to:

- Policy RC-8-a: Existing Standards and Programs. Continue existing beneficial energy conservation programs, including adhering to the California Energy Code in new construction and major renovations.
- Policy RC-8-b: Energy Reduction Targets. Strive to reduce per capita residential electricity use to 1,800 kilowatt hour (kWh) per year and non-residential electricity use to 2,700 kWh per year per capita by developing and implementing incentives, design and operation standards, promoting alternative energy sources, and cost-effective savings.
- Policy RC-8-c: Energy Conservation in New Development. Consider providing an incentive program for new buildings that exceed California Energy Code requirements by fifteen percent.
- Policy RC-8-d: Incentives. Establish an incentive program for residential developers who commit to building all of their homes to ENERGY STAR performance guidelines.
- Policy RC-8-e: Energy Use Disclosure. Promote compliance with State law mandating disclosure of a building's energy data and rating of the previous year to prospective buyers and lessees of the entire building or lenders financing the entire building.

• Policy RC-8-f: City Heating and Cooling. Reduce energy use at City facilities by updating heating and cooling equipment and installing "smart lighting" where feasible and economically viable.

• Policy RC-8-h: Solar Assistance. Identify and publicize information about financial mechanisms for private solar installations and provide over-the-counter permitting for solar installations meeting specified standards, which may include maximum size (in kV) of units that can be so approved.

• Policy RC-8-i: Renewable Target. Adopt and implement a program to increase the use of renewable energy to meet a given percentage of the city's peak electrical load within a given time frame.

• Policy RC-8-j: Alternative Fuel Network. Support the development of a network of integrated charging and alternate fuel station for both public and private vehicles, and if feasible, open up municipal stations to the public as part of network development.

• Policy RC-8-k: Energy Efficiency Education. Provide long-term and on-going education of homeowners and businesses as to the value of energy efficiency and the need to upgrade existing structures on the regular basis as technology improves and structures age.

# IMPACT ANALYSIS

## Thresholds of Significance

In accordance with Appendix F and G of the California Environmental Quality Act (CEQA) Guidelines, energy use impacts associated with the proposed project would be considered significant if it would:

a) Result in the wasteful, inefficient, or unnecessary consumption of energy resources during project construction or operation; or

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

The CEQA Guidelines, Appendix F, requires environmental analyses to include a discussion of potential energy impacts associated with a proposed project. Where necessary, CEQA requires that mitigation measures be incorporated to reduce the inefficient, wasteful or unnecessary consumption of energy. The State CEQA Guidelines, however, do not establish criteria that define inefficient, wasteful or unnecessary consumption. Compliance with the State's building standards for energy efficiency would result in decreased energy consumption for proposed buildings. However, compliance with building codes may not adequately address all potential energy impacts associated with project construction and operation. As a result, this analysis includes an evaluation of electricity and natural gas usage requirements associated with future development, as well as, energy requirements associated with the use of on-road and off-road vehicles. The degree to which the proposed project would comply with existing energy standards, as well as, applicable regulatory requirements and policies related to energy conservation was also taken into consideration for the evaluation of project-related energy impacts.

## Methodology

### *Construction Impacts*

Regarding energy use during construction (e.g., fuel use), it is assumed that only diesel fuel would be used in construction equipment. On-road vehicles for hauling materials and worker commute trips are assumed to use a mix of diesel and gasoline fuel. Construction schedules, equipment numbers, horsepower ratings, and load factors were used to calculate construction-related fuel use, based on default assumptions contained in the California Emissions Estimator Model (CalEEMod), version 2020.4.0. Diesel fuel use was estimated based on a factor of 0.05 gallons of diesel fuel per horsepower-hour derived from the South Coast Air Quality Management District's (SCAQMD) CEQA Air Quality Handbook (SCAQMD 1993). Energy uses were quantified for demolition, site preparation, grading, building construction, paving, and architectural coating.

### *Operational Impacts*

The long-term operation of the proposed project would require electricity and natural gas usage for lighting, water conveyance, and landscaping maintenance equipment. Indirect energy use would include solid waste removal. Project operation would include the consumption of diesel and gasoline fuel from on-road vehicles. Building energy use was estimated using the CalEEMod. With continued improvements in building energy efficiencies, energy use in future years would be less. Transportation fuel-use estimates were calculated by applying average fuel usage rates per vehicle mile to VMT associated with the proposed project. A maximum daily trip rate of 1,323 was used to calculate mobile-source emissions (JBL 2021). Annual energy usage was quantified based on CalEEMod default assumptions for PG&E, including compliance with the RPS. Average fuel usage rates by vehicle class, fuel type (e.g., diesel, gasoline, electric, and natural gas), and calendar year were obtained for Fresno County's emissions inventory and derived from ARB's Emissions Factors (EMFAC) 2017 version 1.0.3 (ARB 2017).

## Project Impacts and Mitigation Measures

Impact E-A. Would the project result in the wasteful, inefficient, or unnecessary consumption of energy resources during project construction or operation?

Implementation of the proposed project would increase electricity, diesel, gasoline, and natural gas consumption associated with construction activities, as well as long-term operational activities. Energy consumption associated with short-term construction and long-term operational activities are discussed in greater detail, as follows:

#### Construction-Related Energy Consumption

Energy consumption would occur during construction, including fuel use associated with the on-site operation of off-road equipment and vehicles traveling to and from the construction site. Table 1 summarizes the levels of energy consumption associated with project construction. As depicted, the operation of off-road construction equipment would use an annual estimated 33,102 gallons of diesel. On-road vehicles would use an annual estimated of 3,713 gallons of gasoline and 35 gallons of diesel. In total, construction fuel use would equate to approximately 4,999 million British thermal units (MMBTU) per year. Construction equipment use and associated energy consumption would be typical of that commonly associated with the construction of new land uses. As a result, project construction would not be anticipated to require the use of construction equipment that would be less energy efficient than those commonly used for the construction of similar facilities. Furthermore, on-site construction equipment may include alternatively-fueled vehicles (e.g., natural gas) where feasible. Energy use associated with the construction of the proposed project would be temporary and would not be anticipated to result in the need for additional capacity, nor would construction be anticipated to result in increased peak-period demands for electricity. As a result, the construction of the proposed project would not result in an inefficient, wasteful, or unnecessary consumption of energy. As a result, impacts are considered less than significant.

**Table 1. Construction Energy Consumption**

| Source | Annual Fuel Use (gallons) | Annual MMBTU |
|---|---|---|
| Off-Road Equipment Use (Diesel) | 33,102 | 4,548 |
| On-Road Vehicles (Gasoline) | 3,713 | 447 |
| On-Road Vehicles (Diesel) | 35 | 5 |
| | Total: | 4,999 |

MMBTU = Million British thermal units
Fuel use was calculated based, in part, on default construction schedules, the equipment uses, and vehicle trips identified for the construction of similar land uses contained in the CalEEMod output files prepared for the air quality analysis conducted for this project.
Refer to Appendix A for modeling assumptions and results.

#### Operational Mobile-Source Energy Consumption

Operational mobile-source energy consumption would be primarily associated with vehicle trips to and from the project. Energy use associated with commute trips are discussed in greater detail, as follows:

Table 2 summarizes the annual fuel use at build-out. As shown in Table 2, the vehicle trips associated with the proposed land use would consume an annual estimated 43,229 gallons of diesel and 89,414 gallons of gasoline. The development of increasingly efficient automobile engines would result in increased energy efficiency and energy conservation. The proposed project would not result in increased fuel usage that would be considered unnecessary, inefficient, or wasteful. This impact would be considered less than significant.

**Table 2. Operational Fuel Consumption**

| Source | Annual Fuel Use (gallons) | Annual MMBTU |
|---|---|---|
| On-Road Vehicles (Diesel) | 43,229 | 5,939 |
| On-Road Vehicles (Gasoline) | 89,414 | 10,759 |
| | Total: | 16,698 |
| MMBTU = Million British thermal units<br>Fuel use was calculated based, in part, on project trip generation rates derived from the traffic analysis for the project.<br>Refer to Appendix A for modeling assumptions and results. | | |

### Operational Building-Use Energy Consumption

The proposed project would result in increased electricity and natural gas consumption associated with the long-term operation of the proposed land use. Estimated electricity and natural gas consumption associated with the proposed facilities are summarized in Table 3. As depicted, the project would result in the annual consumption of approximately 397,952 kWh of electricity, 21,212 kWh of water, and 1,456,040 kilo British thermal units (kBTU) of natural gas. In total, the proposed project would consume an annual total of approximately 2,886 MMBTU. The development of increasingly efficient building fixtures would result in increased energy efficiency and energy conservation. The project would be subject to energy conservation requirements in the CEC (Title 24, Part 6, of the California Code of Regulations, California's Energy Efficiency Standards for Residential and Nonresidential Buildings), and the California Green Building Standards Code (Title 24, Part 11 of the California Code of Regulations). Adherence to Title 24 requirements and previously noted, The City of Fresno General Plan energy policies would ensure that the project would not result in wasteful and inefficient use of non-renewable resources due to building operation. For this reason, this impact would be considered less than significant.

**Table 3. Operational Electricity, Water, and Natural Gas Consumption**

| Source | Annual Energy Use | Annual MMBTU |
|---|---|---|
| Electricity (kWh) | 397,952 | 1,358 |
| Water (kWh) | 21,212 | 72 |
| Natural Gas Use (kBTU) | 1,456,040 | 1,456 |
| | Total: | 2,886 |
| MMBTU = Million British thermal units; kWh = Kilowatt hour; kBTU = Kilo British thermal unit | | |

Impact E-B. Would the project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

The project would be required to be in full compliance with the CBC, including applicable green building standards and building energy efficiency standards. Furthermore, the project would be required to comply with the City of Fresno General Plan energy policies. The energy policies ensure the conservation and preservation of energy resources by increasing the energy efficiency of buildings, appliances, and buildings to the use of alternative forms of energy. The project would not conflict with other goals and policies set forth City of Fresno General Plan pertaining to renewable energy and energy efficiency. Therefore, the proposed project would not conflict with state or local plans for renewable energy or energy efficiency, this impact would be considered less than significant.

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# APPENDIX 4

## Geotechnical Engineering Investigation
## with Geologic Hazards Evaluation

**(Note: Appendices to Appendix 4 are available upon request by contacting Daniel Brannick at daniel@odellplanning.com or (559) 472-7167)**

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM
engineering group, inc.

# GEOTECHNICAL ENGINEERING INVESTIGATION WITH GEOLOGIC HAZARDS EVALUATION

**PROPOSED TEMPERANCE ELEMENTARY SCHOOL**
**SOUTH TEMPERANCE AVENUE AND EAST CALIFORNIA AVENUE**
**FRESNO, FRESNO COUNTY, CALIFORNIA**

**SALEM PROJECT NO. 1-220-0695**
**SEPTEMBER 29, 2020**

***PREPARED FOR:***

**MR. RYAN KILBY**
**SANGER UNIFIED SCHOOL DISTRICT**
**1905 7TH STREET**
**SANGER, CA 93722**

***PREPARED BY:***

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September 29, 2020 Project No. 1-220-0695

Mr. Ryan Kilby
**Sanger Unified School District**
1905 7th Street
Sanger, California 93722

Email: Ryan_Kilby@sanger.k12.ca.us

**Subject:** **GEOTECHNICAL ENGINEERING INVESTIGATION WITH GEOLOGIC SEISMIC HAZARDS EVALUATION**
Proposed Temperance Elementary School Campus
Sanger Unified School District
Near the Southwest Corner of East California and South Temperance Avenue
Fresno, Fresno County, California

Dear Mr. Kilby:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation and Geologic Seismic Hazards Evaluation Report for the Proposed Temperance Elementary School located near the southwest corner of East California and South Temperance Avenue in Fresno, Fresno County, California.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (559) 271-9700.

Respectfully Submitted,

**SALEM ENGINEERING GROUP, INC.**

Ahmad Dalqamouni

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# PROPOSED TEMPERANCE ELEMENTARY SCHOOL
# SOUTH TEMPERANCE AVENUE AND EAST CALIFORNIA AVENUE
# FRESNO, FRESNO COUNTY, CALIFORNIA

## 1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation and Geologic Seismic Hazards Evaluation for the Proposed Temperance Elementary School Campus will be located the undeveloped land near the intersection of East California Avenue and South Temperance Avenue in Fresno, Fresno County, California (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was to conduct site observations, observe and sample the subsurface conditions encountered at the project site, and to provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed.

The recommendations presented herein are based on analysis of the data obtained and reviewed during the investigation and our experience with similar soil and geologic conditions.

If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

## 2. SITE LOCATION AND DESCRIPTION

The proposed Elementary School Campus is planned within a vacant field near the intersection of East California Avenue and South Temperance Avenue in Fresno, Fresno County, California (see Site Plan, Figure 2). At the time of field reconnaissance, it is observed that the site area is completely undeveloped. As the existing project area is essentially level, we anticipate that cuts and fills during earthwork will be minimal and limited to providing a level building pad and positive site drainage.

Google Earth imagery indicates the site lies at a relative elevation of 322 feet above mean sea level.

## 3. PROJECT DESCRIPTION

We understand that the project involves the construction a new elementary school campus. At the time of this proposal, preliminary site plans with building layout and dimensions were not provided to SALEM Engineering Group for review.

Based on review of the site plan provided and request for proposal provided, it is our understanding the planned construction includes six (6) classroom buildings each with plan view areas of about 3,300 square feet and an administration building with a plan view area of about 5,000 square feet. Other improvements such as TK/Kindergarten building, library, multipurpose building, paly courts, etc., were also shown on the

site plan provided. However, based on the request for proposal provided by SIMPRK, it is our understanding that those improvements were not to be included within the 'Phase I' construction. Furture geotechnical explorations may be required for those additional improvements at a later date.

Appurtenant construction is anticipated to include an outdoor amphitheater area, playground structures, asphaltic concrete paving, bus drop off areas, and open landscape areas. It is anticipated that the proposed buildings will be one story construction, supported on shallow spread foundations, with concrete slabs on grade. .The anticipated construction will include wood or steel-framed or CMU wall construction supported on conventional shallow spread foundations and concrete slabs on grade.

Maximum column and wall loads for the Campus Buildings are anticipated to be about 40 to 50 kips and 2 to 3 kips per linear foot, respectively. Maximum total and differential settlement is anticipated be 1 inch and ½ inch, respectively. It is our understanding that new asphaltic concrete pavement is planned adjacent to the proposed Campus Buildings.

A site grading plan was not available at the time of preparation of this report. As the existing project area is essentially level, we anticipate that cuts and fills during earthwork will be around 1 to 2 feet to provide level building pads and positive site drainage. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified. The site configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

## 4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 thru B-12) were drilled on September 1 and 2, 2020 in the area shown on the Site Plan, Figure 2. The test borings were advanced with 4-inch diameter solid-flight auger rotated by a truck-mounted CME-55 drill rig. The test borings were extended to a maximum depth of approximately 51.5 feet below existing grade. The location of the soil borings are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation and exploratory boring logs are presented in Appendix A

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The test boring logs are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location of the test borings were determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted.

Soil samples were obtained from the test borings at the depths shown on the test boring logs. The samples recovered were capped at both ends to preserve the samples at their natural moisture content; bag samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

## 5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, consolidation potential, expansion index, Atterberg limit, resistivity, R-value, and gradation of the soil materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

## 6. SOIL AND GROUNDWATER CONDITIONS

### 6.1 Subsurface Conditions

The subsurface soil conditions encountered appear typical of those found in the geologic region of the site. In general, the soils encountered in the test borings drilled consisted of primarily silty sands underlain by interbedded layers of clayey sand, poorly graded sand, and sandy lean clay to the maximum depth explored of 51.5 feet BSG. Cemented soils, locally referred to as 'hardpan' was encountered at depths as shallow as about 1 feet BSG. The hardpan soils were noted to extend to depths ranging from 5 to 15 feet BSG.

A consolidation test resulted in about 6.2 percent compressibility under a load of 8 kips per square foot. When wetted under a load of 2 kips per square foot, the sample exhibited about 1½ percent collapse. A direct shear test at 1.5 feet BSG resulted in an internal angle of friction of 40 degrees with a cohesion value of 82 pound square foot. An Atterberg limits test indicated the near surface soils has a low plasticity as indicated by plastic index value of 2 and liquid limits value of 16. An expansion index test performed on a near surface soil sample resulted in an expansion index of 2.

An R-value test performed on a near surface sample resulted in an R-value of 63.

Soil conditions described in the previous paragraphs are generalized. Therefore, the reader should consult exploratory boring logs included in Appendix A for soil type, color, moisture, consistency, and USCS classification of the materials encountered at specific locations and elevations.

### 6.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free Groundwater was not encountered within the depth of exploration, 51.5 feet below site grade (BSG). Seasonal perched water conditions may occur due to the shallow depth to hardpan encountered.

Based on review of well date provided on the Department of Water Resources Water Data Library website (https://wdl.water.ca.gov/), State Well Number 367217N1196466W001 located 1.2 miles northeast of the project site, reported a historical high groundwater depth of 11.2 feet BSG in April 1922.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

### 6.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride. The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be less than 50 mg/kg.

ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 6.3 below.

**TABLE 6.3**
**WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS**

| Water Soluble Sulfate ($SO_4$) in Soil, Percentage by Weight | Exposure Severity | Exposure Class | Maximum w/cm Ratio | Minimum Concrete Compressive Strength | Cementations Materials Type |
|---|---|---|---|---|---|
| 0.005 | Not Applicable | S0 | N/A | 2,500 psi | No Restriction |

The water-soluble chloride concentration detected in saturation extract from the soil samples was 23 mg/kg. In addition, testing performed on a near surface soil resulted in a minimum resistivity value of 6,359 ohm-centimeters. Based on the results, these soils would be considered to have a "Moderately Corrosive" potential to buried metal objects (per National Association of Corrosion Engineers, Corrosion Severity Ratings)

It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed. Additional corrosion testing for minimum resistivity may need to be performed if required by the pipe manufacturer.

## 7. GEOLOGIC AND SEISMIC HAZARD EVALUATIONS

### 7.1 Geologic Setting

The project site is in San Joaquin Valley, which is a topographic and structural basin that is bounded on the east by the Sierra Nevada geomorphic province and on the west by the Coast Ranges geomorphic province. The San Joaquin (Great Valley Geomorphic Province) is an alluvial plain about 50 miles wide and 400 miles long in the central part of California (California Geologic Survey (CGS) Note 36). The Great Valley is an elongated trough in which sediments have been deposited almost continuously for the last approximately 160 million years (Jurassic). The Great Valley reaches depths of about 30,000 feet at its southern end, and is filled with a large volume of sediments of Mesozoic through Recent age. Recent alluvium covers nearly the entire valley floor, and has largely been derived from the adjacent Sierra Nevada except in the westernmost portions of the valley floor.

The subject site is mapped by the CGS (Fresno Geologic Sheet[1]) as underlain by Pleistocene age Non-marine deposits (Qc). The sediments in the project area exposed during our recent subsurface exploration indicate the surface soils consist of silty sand with varying amounts of cementation.

A regional geologic map is included as Figure No. 3 at the end of this report. Based on the relatively flat nature of the project and uniform geologic conditions, site specific geologic cross sections are not determined necessary.

## 7.2 Tectonics and Seismicity

Numerous active and potentially active faults are located in the site region and contribute to design seismic ground motion estimates. An "active fault" is defined, for the purpose of this evaluation, as a fault that has had surface displacement within the Holocene age (about the last 11,700 years).

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application *2008 National Seismic Hazard Maps - Fault Parameters*. Site latitude is 36.7180 North; site longitude is -119.6670 West. The ten closest active faults are summarized below in Table 7.2.

**TABLE 7.2**
**REGIONAL FAULT SUMMARY**

| Fault Name | Distance to Site (miles) | Maximum Earthquake Magnitude, $M_w$ |
|---|---|---|
| Great Valley 13 (Coalinga) | 45.15 | 7.1 |
| Great Valley 12 | 45.72 | 6.4 |
| Great Valley 11 | 46.08 | 6.6 |
| Great Valley 14 (Kettleman Hills) | 48.26 | 7.2 |
| Great Valley 10 | 54.74 | 6.5 |
| Great Valley 9 | 60.40 | 6.8 |
| Ortigalita | 68.25 | 7.1 |
| Round Valley | 68.36 | 7.1 |
| San Andreas fault - creeping segment | 69.99 | N/A |
| S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG | 70.17 | 8.0 |

*The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.*

[1] Matthews, R.A., and Burnett, J.L., 1965, Geologic map of California : Fresno sheet: California Division of Mines and Geology, scale 1:250,000

### 7.3 Geologic Hazards Evaluation

The potential geologic hazards of flooding, landslides, and volcanic activity are described in the following subsections

#### 7.3.1 Flooding

Based on FEMA Flood Insurance Rate Map No. 06019C2135H dated February 18, 2009, the subject site area is partially labeled other flood areas Zone X, which designates areas of minimal flood hazard that are outside of a Special Flood Hazard Area (SFHA) and is in an area of 0.2% annual chance flood; area of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood (Figure 6).

#### 7.3.2 Landslides

The site vicinity is flat. There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

#### 7.3.3 Volcanic Activity

California includes six regions with a history of late Pleistocene and Holocene volcanic eruptions that are subject to hazards from future eruptions (Miller, 1989). Of these six regions, the Mono Lake-Long Valley area is the closest. This area is located about 110 miles northeast of the site. Based on review of Plate 1, Miller 1989, the subject site is not located within any designated volcanic hazard zones.

Based on the distance of volcanic hazards from the site, the prospect for volcanic hazards to impact the site during the design life of the facility is considered low.

## 8. OTHER GEOLOGIC HAZARDS

### 8.1 Expansive Soils

One of the potential geotechnical hazards evaluated at this site is the expansion potential of the near surface soils. Expansive soils experience shrink and swell due to moisture content fluctuations throughout the dry and wet season. If not addressed, the potential for shrinkage and heave would have an impact on foundations and lightly loaded slabs. The potential for damage to slabs-on-grade and foundations supported on expansive soils can be reduced by placing non-expansive fill below the slabs-on-grade.

Based on the granular nature of the near surface soils encountered and our experience in the near site vicinity, the near surface soils are considered to have very low expansion potential (EI = 2). Thus, the potential to damage due to heave of expansive soils is not a concern for the site.

### 8.2 Corrosion Protection

The risk of corrosion of construction materials relates to the potential for soil-induced chemical reaction. Corrosion is a naturally occurring process whereby the surface of a metallic structure is oxidized or reduced to a corrosion product such as iron oxide (i.e., rust).

Testing performed on a near surface soil resulted in a minimum resistivity value of 6,359 ohm-centimeters. Based on the results, these soils would be considered to have a "Moderately Corrosive" potential to buried metal objects (per National Association of Corrosion Engineers, Corrosion Severity Ratings).

### 8.3 Sulfate Attack of Concrete

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration. ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class.

The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be less than 50 mg/kg (<0.005 Percent by weight). Therefore, the potential for sulfate attack on concrete is considered negligible.

## 9. CONDITIONAL GEOLOGIC HAZARDS:

Conditional geologic hazards, as identified in section 31 of California Geological Survey Note 48, are discussed in the following subsections.

### 9.1 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a significant hazard at the site. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

### 9.2 Hazardous Materials

Hazardous materials such as methane gas, hydrogen-sulfide gas and tar seeps are not known to be present in the project area and are not considered to be a concern at the subject site.

### 9.3 Radon Gas

Based on review of the California Geologic Survey Indoor Radon Test Results [2]the site, located in zip code 93727, is in an area identified as having indoor radon screening levels of about 3.9 pCi/L. Given the site is expected to experience less than 4pCi/L, the site is less than the recommended EPA's recommended action level for radon exposure. Provided the buildings are constructed with adequate ventilation, radon exposure is not considered a concern.

### 9.4 Naturally Occurring Asbestos

Asbestos commonly occurs in soil and ultramafic rocks such as serpentinite throughout California. Ultramafic rocks are scattered throughout much of the Sierra Nevada Mountain and the Coast Range regions. Based on review of the Open-File Report 2000-19, titled A General Location Guide for Ultramafic Rocks in California - Areas More Likely to Contain Naturally Occurring Asbestos, prepared by the State of California Department of Conservation, Division of Mines and Geology, dated August, 2000, ultramafic

https://www.cdph.ca.gov/Programs/CEH/DRSEM/CDPH%20Document%20Library/EMB/Radon/Radon%20Test%20Results.pdf

rock is identified 15 miles east of the site. Based on the cited literature and our site observations, it is our opinion that the potential to encounter near surface naturally occurring asbestos containing rock at the site is very low.

### 9.5 Hydrocollapse

Collapsible soils typically consist of loose, dry, low-density soils that, when wetted, will experience settlement/consolidation. Based on the results of testing performed on a relatively undisturbed near surface soil sample, when wetted under a load of 2 kips per square foot these soils exhibited approximately 1.5 percent collapse. Based on the results of the testing performed, the near surface soils are identified as having slight collapse potential. Provided the recommendations to support foundations on a uniform layer of engineered fill are followed, the potential for hydrocollapse is not a concern for the proposed construction.

### 9.6 Regional Subsidence

Based on our review of an online map published by California Water Science Center[3], the site is not located in an area of recorded subsidence.

## 10. SEISMIC HAZARDS

The potential for fault ground rupture, seismic ground shaking and seismic coefficients/earthquake spectral response acceleration design values, and liquefaction and seismic settlement are described in the following subsections.

### 10.1 Active Faulting and Surface Fault Rupture

Based on mapping and historical seismicity, the seismicity of the Fresno Area has been generally considered low by the scientific community. The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards nor within an Alquist-Priolo Earthquake Fault (Special Studies) Zone, therefore, a site specific fault study investigation by an Engineering Geologist is not required. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

The nearest faults to the project site are associated with the Great Valley Fault system located approximately 55 miles west from the site. There are no known active fault traces in the immediate project vicinity.

A map depicting the major active faults in the vicinity of the site is included on Figure No. 4 at the end of this report. Considering the distance to the nearest known active fault, the potential for surface fault rupture at the site due to a known active fault is considered low.

### 10.2 Historic Seismic Activity

The general area of the site has experienced recurring seismic activity. Based on historical earthquake data obtained from the U.S. Geological Survey's earthquake database system, approximately 235 historical earthquakes with magnitude 4.5 or greater have been recorded from 1900 through September 29, 2020

[3] https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html

within about 100 miles of the site. A map showing the location of the project site with relation to the approximate historical earthquake epicenter locations and magnitude category is presented on Figure No. 5 at the end of this report.

The nearest earthquake event (estimated magnitude of 4.6) found during the search occurred north of Coalinga on August 3, 1975, with a reported location of approximately 44 miles southwest of the site. The nearest magnitude earthquake identified within a 100 mile search radius was the 6.7 magnitude Coalinga earthquake, which occurred on May 2, 1983, approximately 49 miles southwest of the site (peak ground acceleration in the vicinity of the site of about 0.066g).

### 10.3 Design Seismic Ground Motion Parameters and Site Class

Seismic coefficients and spectral response acceleration values were developed based on the 2019 California Building Code (CBC). The CBC methodology for determining design ground motion values is based on the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, which incorporate both probabilistic and deterministic seismic ground motion. A site specific ground motion hazard analysis was not included in this investigation. Based on our understanding of the proposed project the project Structural Engineer will utilize code exceptions listed in ASCE 7-16 section 11.4.8 for design of planned foundations. Therefore, Site Specific Ground Motion Hazard Analysis is not required.

Based on the 2019 CBC, a Site Class D represents the on-site soil conditions with standard penetration resistance, N-values, averaging between 15 and 50 blows per foot in the upper 100 feet below site grade. A table providing the recommended design acceleration parameters for the project site, based on a Site Class D designation, is included in section 11.6 of this report.

Based on Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, the estimated design peak ground acceleration adjusted for site class effects ($PGA_M$) was determined to be 0.329 g (based on both probabilistic and deterministic seismic ground motion).

### 10.4 Liquefaction and Seismic Settlement

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However, liquefaction has occurred in soils other than clean sand.

In general, the soils encountered generally consisted of silty sands to depths ranging from 1 to 26.5 feet BSG. The silty sands were underlain by interbedded layers of clayey sand, sandy silt, silty sand, and sandy lean clay to the maximum depth explored of 51.5 feet BSG. A Free groundwater was not encountered during our field exploration. ). Based on review of well date provided on the Department of Water Resources Water Data Library website (http://www.wdl.water.ca.gov/), State Well Number 367217N1196466W001 located 1.2 miles northeast of the project site, reported a historical high groundwater depth of 11.2 feet BSG in April 1922.

A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of the liquefied sands. According to the State of California, Seismic Hazard Zonation Program, the site is NOT located within the potential liquefaction zone.

A liquefaction/seismic settlement evaluation was performed using LiquefyPro computer program (version 5.9c) developed by Civiltech. For the analysis, a maximum earthquake magnitude of 5.5 $M_w$ (determined from USGS Unified Hazard Tool, Dynamic Conterminous U.S. 2008 Deaggregation), a design peak horizontal ground surface acceleration of 0.329g ($PGA_M$), a historic groundwater depth of 11 feet, and data obtained from test boring B-12 were utilized for the liquefaction analysis. Based on our analysis the potential for liquefaction and/or seismic settlement (including dry seismic settlement), the total seismic induced settlement is expected to be about ½ inch and differential seismic settlement of about ¼ inch in 40 feet.

Based on the results of this analysis, loss of bearing and surface manifestations due to liquefaction is not anticipated to be a concern for the subject site.

### 10.5 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to the lack of groundwater near the surface and relatively flat nature of the site, we judge the likehood of lateral spreading to be low.

## 11. CONCLUSIONS AND RECOMMENDATIONS

### 11.1 General

11.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

11.1.2 In general, the soils encountered mainly consisted of silty sands to depths ranging from 1 to 30 feet BSG. The silty sands were underlain by interbedded layers of poorly graded sand, sandy clay and clayey sand to the maximum depth explored of 51.5 feet BSG. Cemented soils, locally referred to as 'hardpan' was encountered at a depth of about 1 feet BSG. The hardpan soils were noted to extend to depths ranging from 5 to 15 feet BSG.

11.1.3 The near surface soils have low compressibility characteristics and slight collapse potential. Based on the granular nature of the soils encountered and laboratory testing of the upper soils have a very low expansive potential (EI=2). When compacted as engineered fill, the near surface soils have excellent pavement support characteristics.

11.1.4 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed improvements may be supported using conventional shallow foundations

provided that the recommendations presented herein are incorporated in the design and construction of the project.

11.1.5 Provided the site is graded in accordance with the recommendations of this report and foundations constructed as described herein, we estimate that total settlement due to static loads utilizing conventional shallow foundations of about 1-inch and corresponding differential static of ½ inch in 40 feet.

11.1.6 Total and differential seismic settlements on the order of ½ inch and ¼ inch in 40 feet, respectively, are anticipate due to design level seismic events.

11.1.7 Based on the chemistry testing performed, the near surface soils have 'negligible' potential for sulfate attack on concrete and are considered to be mildly corrosive to buried metal objects.

11.1.8 All references to relative compaction and optimum moisture content in this report are based on ASTM D 1557 (latest edition).

11.1.9 We should be retained to review the project plans as they develop further, provide engineering consultation as-needed, and perform geotechnical observation and testing services during construction.

**11.2 Surface Drainage**

11.2.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

11.2.2 The ground immediately adjacent to foundations shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet. Impervious surfaces within 10 feet of building foundations shall be sloped a minimum of 2 percent away from the building and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structures. Over-irrigation within landscaped areas adjacent to the structures should not be performed.

11.2.3 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

**11.3 Site Grading**

11.3.1 A representative of our firm should be present during all site clearing and grading operations to test and/or observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon

the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

11.3.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

11.3.3 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, undocumented fill, underground buried structures, and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. After demolition activities, it is recommended that disturbed soils be removed and/or replaced with compacted engineered fill soils.

11.3.4 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), disturbed soil, any existing uncertified/undocumented fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report. Any disturbed subgrade, undocumented fill materials or loose unsuitable materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the over-excavation should be determined by our field representative during construction

11.3.5 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

11.3.6 Removal of trees and loose disturbed soils from existing site conditions will be an integral part of the site preparation. Existing trees should be removed and their root systems should be thoroughly cleared of root balls as well as isolated roots greater than ¼-inch in diameter. The root system removal may disturb a significant quantity of soil. Following tree removal, all loose and disturbed soil should be removed from the tree wells. Any areas or pockets of soft or loose soils, void spaces made by burrowing animals, undocumented fill, or other disturbed soil (i.e. soil disturbed by root removal) that are encountered, should be excavated to expose approved firm native material. Care should be taken during site grading to mitigate (e.g. excavate and compact as engineered fill) all soil disturbed by demolition and tree removal activities

11.3.7 Structural building pad areas and over-build zone should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings and non-cantilevered overhangs carrying structural loads.

11.3.8 To provide uniform support for the proposed building, it is recommended that over-excavation extend to at least 12 inches below preconstruction site grade, 12 inches below foundations, or to the depth required to remove any undocumented fills. The resulting bottom of excavation shall be scarified to a minimum depth of at least 12 inches, worked until uniform and free from large clods, moisture conditioned to slightly above optimum moisture, and compacted to 92 percent of the

maximum density. The horizontal limits of the over-excavation should extend throughout the building pad and over-build zone, extending laterally to a minimum of 5 feet beyond the outer edges of the proposed footings

11.3.9 Interior slabs on grade should be supported on a minimum of 4 inches of Class 2 aggregate base compacted to 95 percent relative compaction, over the depth of engineered fill recommended below foundations.

11.3.10 Areas of proposed lightly loaded shallow spread foundations (i.e. retaining walls, screen walls, etc.) should be over-excavated to minimum depths of one (1) foot below existing grade, to the bottom of proposed footing bottom, or depth required to remove undocumented fills, whichever is deeper. The over-excavation should also extend laterally to a minimum of 3 feet beyond the outer edges of the proposed footings. The resulting bottom of excavation shall be scarified to a minimum depth of at least 8 inches, worked until uniform and free from large clods, moisture-conditioned to slightly above optimum moisture, and compacted to a minimum of 92 percent of the maximum density.

11.3.11 Areas of exterior concrete slabs on grade located outside the building pad over-build zone, should be prepared by scarification of the upper 12 inches below existing grade or 12 inches below the bottom of the recommended aggregate base section, whichever is greater. The zone of subgrade preparation should extend a minimum of 3 feet beyond these improvements. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.

Exterior slabs on grade should be supported on a minimum of 4 inches of Class 2 aggregate base compacted to 95 percent relative compaction over subgrade soils prepared as recommended above. As an alternative, if the School District is willing to accept additional risk for distress to exterior slabs, slabs on grade located outside the building pad may be supported directly over compacted subgrade soils as recommended above.

11.3.12 Areas of proposed asphaltic concrete and Portland cement concrete pavements should be prepared by over-excavation to 12 inches below preconstruction site grade or 12 inches below bottom of proposed aggregate base section, whichever provides greater fill. The bottom of excavation should be scarified a minimum of 8 inches, moisture conditioned to slightly above optimum and compacted as engineered fill. The horizontal limits of the over-excavation should extend a minimum of 3 feet beyond these improvements. The upper 12 inches below bottom of pavement sections should be compacted to a minimum of 95 percent relative compaction.

11.3.13 Areas to receive engineered fill outside the building pad over-build zone, should be prepared by scarification of the upper 12 inches below existing grade or 12 inches below the recommended base section, whichever is greater. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.

11.3.14 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

11.3.15 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

11.3.16 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier months of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties. Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

11.3.17 Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation. To expedite the stabilizing process, crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose.

If the use of crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of ¾-inch to 1-inch crushed rocks. The thickness of the rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. All open graded crushed rock/gravel should be fully encapsulated with a geotextile fabric (such as Mirafi 140N) to minimize migration of soil particles into the voids of the crushed rock. Although it is not required, the use of geogrid (e.g. Tensar BX 1100, BX 1200 or TX 160) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization.

Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

## 11.4 Soil and Excavation Characteristics

11.4.1 Based on the soil conditions encountered in our borings, the onsite soils can be excavated with moderate excavation equipment, particularly for trenches. As noted, hardpan soils were encountered at depths greater than about 1 foot BSG. Where encountered, the contractor should anticipate increased excavation effort will be required. In addition, hardpan fragments will require processing and blending with on-site soils prior to use as engineered fill.

11.4.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements. Temporary excavations are further discussed in a later Section of this report.

11.4.3 The near surface soils identified as part of our investigation are, generally, damp to moist due to the absorption characteristics of the soil. Seasonal perched water conditions may occur due to the shallow depth to hardpan encountered. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

## 11.5 Materials for Fill

11.5.1 On-site soils are suitable for use as general Engineered Fill, provided they do not contain deleterious matter, organic material, or rock/cemented hardpan fragments material larger than 3 inches in maximum dimension. The resultant engineered fill material should be well graded to a uniform mixture to prevent nesting of large particles.

11.5.2 Imported Non-Expansive Engineered Fill soil, should be well-graded, very low-to-non-expansive slightly cohesive silty sand or sandy silt. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 11.5.2.

**TABLE 11.5.2**
**IMPORT FILL REQUIREMENTS**

| | |
|---|---|
| Percent Passing 3-inch Sieve | 100 |
| Percent Passing No.4 Sieve | 75-100 |
| Percent Passing No 200 Sieve | 15-40 |
| Maximum Plasticity Index | 15 |
| Maximum Organic Content | 3% by Weight |
| Maximum Expansion Index (ASTM D4829) | 20 |

Prior to importing fill, the Contractor shall submit test data that demonstrates that the proposed import complies with the recommended criteria for both geotechnical and environmental compliance. Also, prior to being transported to the site, the import material shall be certified by the Contractor and the supplier (to the satisfaction of the School District) that the soils do not contain any environmental contaminates regulated by local, state or federal agencies having jurisdiction. This certification shall consist of, as a minimum, analytical data specific to the source of the import material in accordance with the Department of Toxic Substances Control, "Informational Advisory, Clean Imported Fill Material," dated October 2001. The list of constituents to be tested for the fill source shall be submitted to FUSD for review and approval prior to the Contractor testing the fill.

Contractors should provide a minimum of 14 working days after sample collection to complete the DTSC and geotechnical testing.

11.5.3 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in lifts no thicker than will allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

11.5.4 On-Site soils used as engineered fill soils should moisture conditioned to slightly above optimum moisture content, and compacted to at least 92 percent relative compaction.

11.5.5 Import Engineered Fill, if selected, should be placed, moisture conditioned to slightly above optimum moisture content, and compacted to at least 92 percent relative compaction.

11.5.6 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

11.5.7 Environmental characteristics and corrosion potential of import soil materials should also be considered.

11.5.8 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

11.5.9 Aggregate base material should meet the requirements of a Caltrans Class 2 Aggregate Base. The aggregate base material should conform to the requirements of Section 26 of the Standard Specifications for Class 2 material, ¾-inch or 1½-inches maximum size. The aggregate base material should be compacted to a minimum relative compaction of 95 percent based ASTM D1557. The aggregate base material should be spread in layers not exceeding 6 inches and each layer of aggregate material course should be tested and approved by the Soils Engineer prior to the placement of successive layers.

## 11.6 Seismic Design Criteria

11.6.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2019 CBC, our recommended parameters are shown below. These parameters were determined using California's Office of Statewide Health Planning and Development (OSHPD) (https://seismicmaps.org/) in accordance with the 2019 CBC. The Site Class was determined based on the soils encountered during our field exploration. Based on our understanding of the project, the Structural Engineer will utilize code exceptions summarized under ASCE 7-16, 11.4.8. Therefore, a site specific ground motion hazard analysis is not required.

**TABLE 11.6.1**
**2019 CBC SEISMIC DESIGN PARAMETERS**

| Seismic Item | Symbol | Value | 2010 ASCE 7 or 2019 CBC Reference |
|---|---|---|---|
| Site Coordinates (Datum = NAD 83) | | 36.7180 Lat<br>-119.6670 Lon | |
| Site Class | -- | D | ASCE 7 Table 20.3 |
| Soil Profile Name | -- | Stiff Soil | ASCE 7 Table 20.3 |
| Risk Category | -- | III | CBC Table 1604.5 |
| Site Coefficient for PGA | $F_{PGA}$ | 1.358 | ASCE 7 Table 11.8-1 |
| Peak Ground Acceleration<br>(adjusted for Site Class effects) | $PGA_M$ | 0.329 g | ASCE 7 Equation 11.8-1 |
| Seismic Design Category | SDC | D | ASCE 7 Table 11.6-1 & 2 |
| Mapped Spectral Acceleration<br>(Short period - 0.2 sec) | $S_S$ | 0.559 g | CBC Figure 1613.2.1(1-6) |
| Mapped Spectral Acceleration<br>(1.0 sec. period) | $S_1$ | 0.220 g | CBC Figure 1613.3.1(1-6) |
| Site Class Modified Site Coefficient | $F_a$ | 1.353 | CBC Table 1613.3.3(1) |
| Site Class Modified Site Coefficient | $F_v$ | **2.160*** | CBC Table 1613.3.3(2) |
| MCE Spectral Response Acceleration<br>(Short period - 0.2 sec) $S_{MS} = F_a S_S$ | $S_{MS}$ | 0.756 g | CBC Equation 16-36 |
| MCE Spectral Response Acceleration<br>(1.0 sec. period) $S_{M1} = F_v S_1$ | $S_{M1}$ | **0.475 g*** | CBC Equation 16-37 |
| Design Spectral Response Acceleration<br>$S_{DS}=\frac{2}{3}S_{MS}$ (short period - 0.2 sec) | $S_{DS}$ | 0.504 g | CBC Equation 16-38 |
| Design Spectral Response Acceleration<br>$S_{D1}=\frac{2}{3}S_{M1}$ (1.0 sec. period) | $S_{D1}$ | **0.317 g*** | CBC Equation 16-39 |
| Short Period Transition Period ($S_{D1}/S_{DS}$), Seconds | $T_S$ | 0.629 | ASCE 7-16, Section 11.4.6 |
| Long Period Transition period (seconds) | $T_L$ | 12 | ASCE 7-16, Figures 22-14 through 22-17 |

**Note: * Determined per ASCE Table 11.4.8 for use in calculating $T_S$ only.**

**Site Specific Ground Motion Analysis was not included in the scope of this investigation. Per ASCE 11.1.48, Structures on Site Class D, with $S_1$ greater than or equal to 0.2 may require Site Specific Ground Motion Analysis. However, a site specific ground motion analysis may not be required based on Exceptions listed in ASCE 11.4.8. The Structural Engineer should verify whether exceptions summarized in ASCE 7-16, Section 11.4.8 is valid for the site. In the event a site specific ground motion analysis is required, SALEM should be contacted for these services.**

11.6.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

## 11.7 Shallow Foundations

11.7.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings supported on engineered fill soils prepared in accordance with Section 11.3 of this report. Shallow foundations supported on engineered fill as recommended in this report may be designed based on total and differential static settlement of 1 inch and ½ inch in 40 feet, respectively.

11.7.2 The bearing wall footings considered for the Campus Buildings should be continuous with a minimum width of 12 inches and extend to minimum depths of 18 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 15 inches and extend a minimum depth of 18 inches below the lowest adjacent grade. The buildings foundations should have a minimum width of 12 inches and depth of 12 inches below lowest adjacent grade.

11.7.3 Lightly loaded foundations for screen walls, retaining walls, etc., should have a minimum width of 12 inches and minimum depth of 12 inches below adjacent grade.

11.7.4 Footing concrete should be placed into neat excavation. The footing bottoms shall be maintained free of loose and disturbed soil.

11.7.5 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

| Loading Condition | Allowable Bearing |
|---|---|
| Dead-Plus-Live Load | 3,000 psf |
| Total Load, Including Wind or Seismic Loads | 3,990 psf |

11.7.6 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.39 acting between the base of foundations and the supporting engineered fill subgrade.

11.7.7 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 350 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in

determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination in Section 1605.3.2 of the 2019 CBC that includes wind or earthquake loads.

11.7.8 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

11.7.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

## 11.8 Interior Concrete Slabs-on-Grade

11.8.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 5 inches thick and underlain by four (4) inches of class 2 aggregate base compacted to 95 percent relative compaction over engineered fill extending below foundations.

11.8.2 We recommend reinforcing slabs, at a minimum, welded wire or fiber mesh reinforcement. The type of reinforcement should be selected by the structural engineer.

11.8.3 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that full depth construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs.

11.8.4 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.

11.8.5 It is recommended that the utility trenches within the structure be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the structures is recommended.

11.8.6 Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structure is recommended to reduce the accumulation of interior moisture.

11.8.7 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings, coatings, underlayments, adhesives, moisture sensitive goods, humidity controlled environments, or climate cooled environments are anticipated, construction should have a suitable waterproof vapor retarder

(a minimum of 15 mils thick, is recommended, polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be a decay resistant material complying with ASTM E96 or ASTM E1249 not exceeding 0.01 perms, ASTM E154 and ASTM E1745 Class A. The vapor retarder should, maintain the recommended permeance **after** conditioning tests per ASTM E1745. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-18.

11.8.8 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped. Extend vapor retarder over footings and seal to foundation wall or slab at an elevation consistent with the top of the slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities or columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab as well as at the slab perimeter.

11.8.9 Avoid use of stakes driven through the vapor retarder.

11.8.10 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

11.8.11 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

## 11.9 Exterior Concrete Slabs on Grade

11.9.1 The following recommendations are intended for lightly loaded exterior slabs on grade not subject to vehicular traffic. Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by four (4) inches of class 2 aggregate base over subgrade soils prepared in accordance with the recommendations in section 11.3 of this report. As an alternative, if the School District is willing to accept additional risk for distress to exterior slabs, slabs on grade located outside the building pad may be supported directly over compacted subgrade soils as recommended above.

11.9.2 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that full depth construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

11.9.3 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement.

11.9.4 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

## 11.10 Lateral Earth Pressures and Frictional Resistance

11.10.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

| Lateral Pressure Conditions | Soil Equivalent Fluid Pressure |
|---|---|
| Active Pressure, Drained, pcf | 29 |
| At-Rest Pressure, Drained, pcf | 48 |
| Allowable Passive Pressure, psf | 350 |
| Allowable Coefficient of Friction | 0.39 |
| Minimum Wet Unit Weight ($lbs/ft^3$) | 105 |
| Maximum Wet Unit Weight ($lbs/ft^3$) | 135 |

11.10.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure. The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

11.10.3 The allowable parameters include a safety factor of 1.5 and can be used in design for direct comparison of resisting loads against lateral driving loads.

11.10.4 If combined passive and frictional resistance is used in design, a 50 percent reduction in frictional resistance is recommended.

11.10.5 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

11.10.6 For dynamic seismic lateral loading the following equation shall be used:

| Dynamic Seismic Lateral Loading Equation |
|---|
| Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$ |
| Where: $\gamma$ = Maximum In-Place Soil Density (Section 11.10.1 above) |
| $K_h$ = Horizontal Acceleration = $\frac{2}{3}PGA_M$ (Section 11.6.1 above) |
| H = Wall Height |

## 11.11 Retaining Walls

11.11.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to Class 2 permeable materials graded in accordance with the current Caltrans Standard Specifications.

11.11.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

11.11.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements.

11.11.4 The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than ¼-inch in diameter.

11.11.5 If retaining walls are less than 5 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the Caltrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

11.11.6 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

## 11.12 Temporary Excavations

11.12.1 We anticipate that the majority of the dense site soils will be classified as Cal-OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

11.12.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges

from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

11.12.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

11.12.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

**RECOMMENDED EXCAVATION SLOPES**

| Depth of Excavation (ft) | Slope (Horizontal : Vertical) |
|---|---|
| 0-5 | 1:1 |
| 5-10 | 1½:1 |
| 10-15 | 2:1 |

11.12.5 If, due to space limitation, excavations near existing structures are performed in a vertical position, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

11.12.6 Braced shorings should be designed for a maximum pressure distribution of 20H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

11.12.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

## 11.13 Underground Utilities

11.13.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 92 percent relative compaction at or above optimum moisture content. The upper 12 inches of trench backfill within

asphalt or concrete paved areas shall be moisture conditioned to at or above optimum moisture content and compacted to at least 95 percent relative compaction.

11.13.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 12 inches above the crown of the pipe. Pipe bedding, haunches and initial fill extending to 1 foot above the pipe should consist of a clean well graded sand with 100 percent passing the #4 sieve, a maximum of 15 percent passing the #200 sieve, and a minimum sand equivalent of 20.

11.13.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the building or structure to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

11.13.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

## 11.14 Pavement Design

11.14.1 R-Value testing was performed on a sample obtained from the site at the location shown on the attached site plan (Boring B-4). The sample was tested in accordance with the State of California Materials Manual Test Designation 301. R-Value testing on a near surface sample resulted in an R-value of 63. Therefore, based on requirements of Caltrans Highway Design Manual, an R-value of 50 was selected for design.

11.14.2 The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. The asphaltic concrete (flexible pavement) is based on a 20-year pavement life. The following table shows the recommended pavement sections for traffic indices between 5.0 and 8.0.

**TABLE 11.14.2**
**ASPHALT CONCRETE PAVEMENT THICKNESSES**

| Traffic Index | Asphaltic Concrete, (inches) | Class 2 Aggregate Base, (inches)* | Compacted Subgrade, (inches)* |
|---|---|---|---|
| 5.0 | 2.5 | 4.0 | 12.0 |
| 6.0 | 3.0 | 4.0 | 12.0 |
| 7.0 | 4.0 | 4.5 | 12.0 |
| 8.0 | 4.5 | 6.0 | 12.0 |

**** 95% compaction based on ASTM D1557-07 Test Method***

11.14.3 The following recommended Portland Cement Concrete pavement sections for traffic indexes ranging from 5.0 to 8.0.

**TABLE 11.14.3**
**PORTLAND CEMENT CONCRETE PAVEMENT THICKNESSES**

| Traffic Index | Portland Cement Concrete, (inches)* | Class 2 Aggregate Base, (inches)** | Compacted Subgrade. (inches)** |
|---|---|---|---|
| 5.0 | 6.0 | 4.0 | 12.0 |
| 6.0 | 6.0 | 4.0 | 12.0 |
| 7.0 | 6.5 | 4.0 | 12.0 |
| 8.0 | 7.0 | 4.0 | 12.0 |

**** Minimum Compressive Strength of 4,000 psi***
***** 95% compaction based on ASTM D1557-07 Test Method***

11.14.4 Asphalt concrete should conform to Section 39 of Caltrans' latest Standard Specifications for ½ inch Hot Mix Asphalt (HMA) Type A or B. Asphaltic concrete pavements should be placed in accordance with Caltrans Standard Specifications.

11.14.5 Based on the shallow depth to hardpan soils, there is a potential for perched water conditions to occur. Therefore, to prevent migration of water below pavement areas, where pavements adjoin open areas or landscape areas, an inverted curb should be constructed to the bottom of the proposed aggregate base section.

11.14.6 Excavations, depressions, or soft and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. Any buried structures encountered during construction should be properly removed and backfilled.

11.14.7 Buried structures encountered during construction should be properly removed/rerouted and the resulting excavations backfilled. It is suspected that demolition activities of the existing pavement will disturb the upper soils. After demolition activities, it is recommended that disturbed soils within pavement areas be removed and/or compacted as engineered fill.

11.14.8 An integral part of satisfactory fill placement is the stability of the placed lift of soil. Prior to placement of aggregate base, the subgrade soils should be proof-rolled by a loaded water truck (or equivalent) to verify no deflections of greater than ½ inch occur. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

11.14.9 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material.

## 12. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

### 12.1 Plan and Specification Review

12.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

### 12.2 Construction Observation and Testing Services

12.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

12.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

12.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

## 13. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between borings. The nature and extent of such variations may not become evident until construction is initiated.

If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 271-9700.

Respectfully Submitted,

**SALEM ENGINEERING GROUP, INC.**

Ahmad Dalqamouni, Ph.D., M.CE
Geotechnical Project Engineer
Central / Northern California

Dean B. Ledgerwood II, CEG
Geotechnical Manager
CEG 2613


R. Sammy Salem, PE, GE
Principal Managing Engineer
RCE 52762 / RGE 2549

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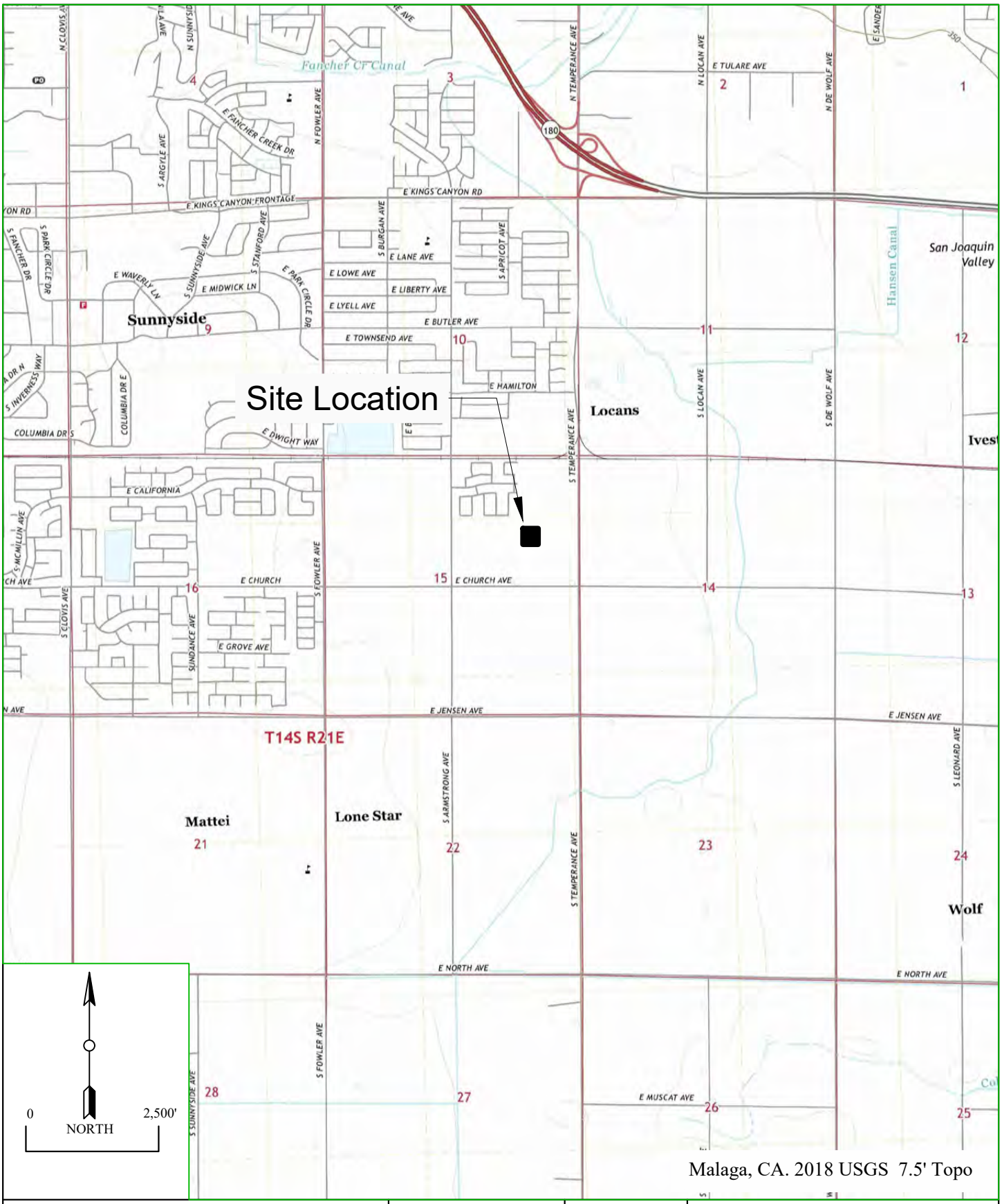
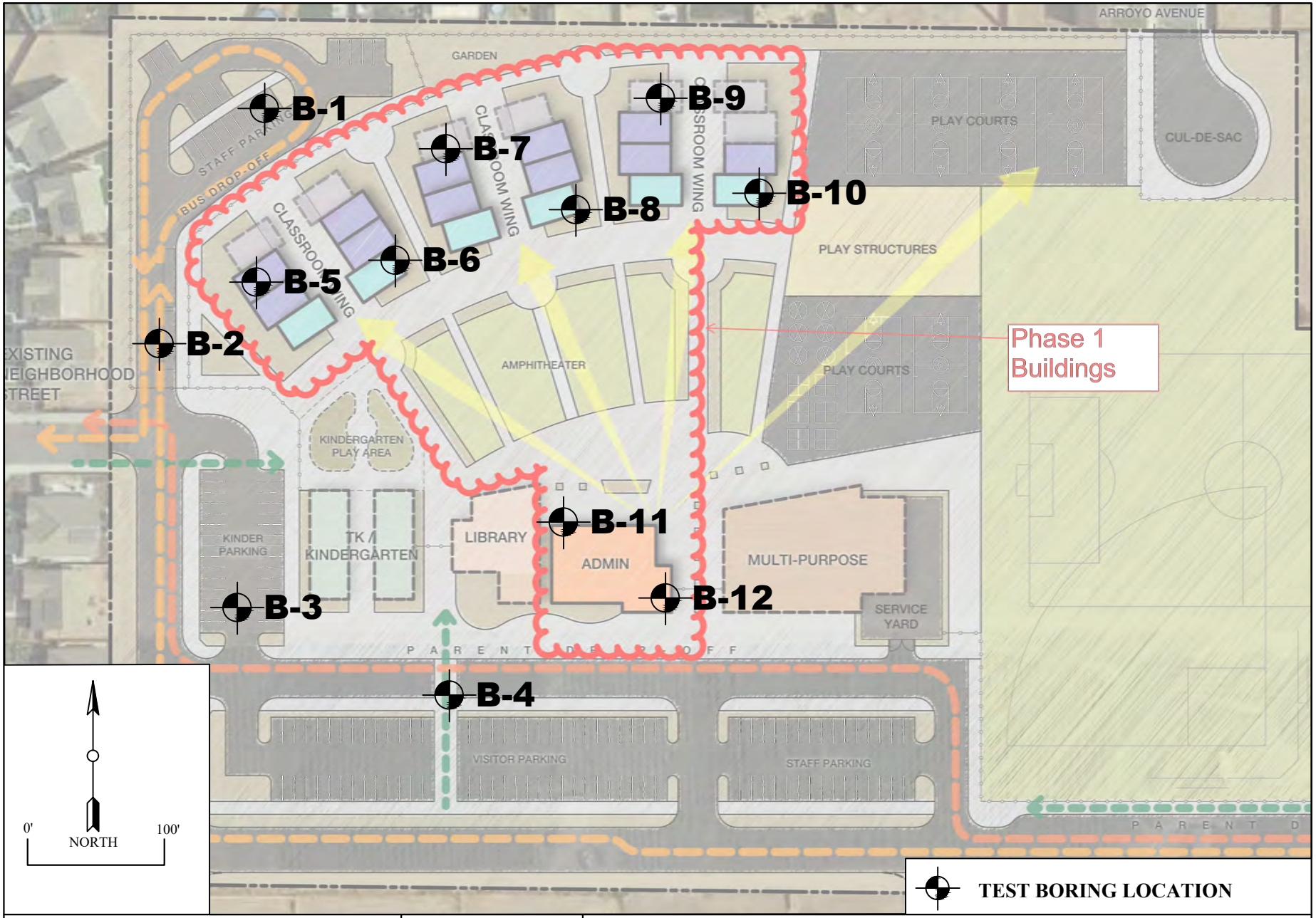


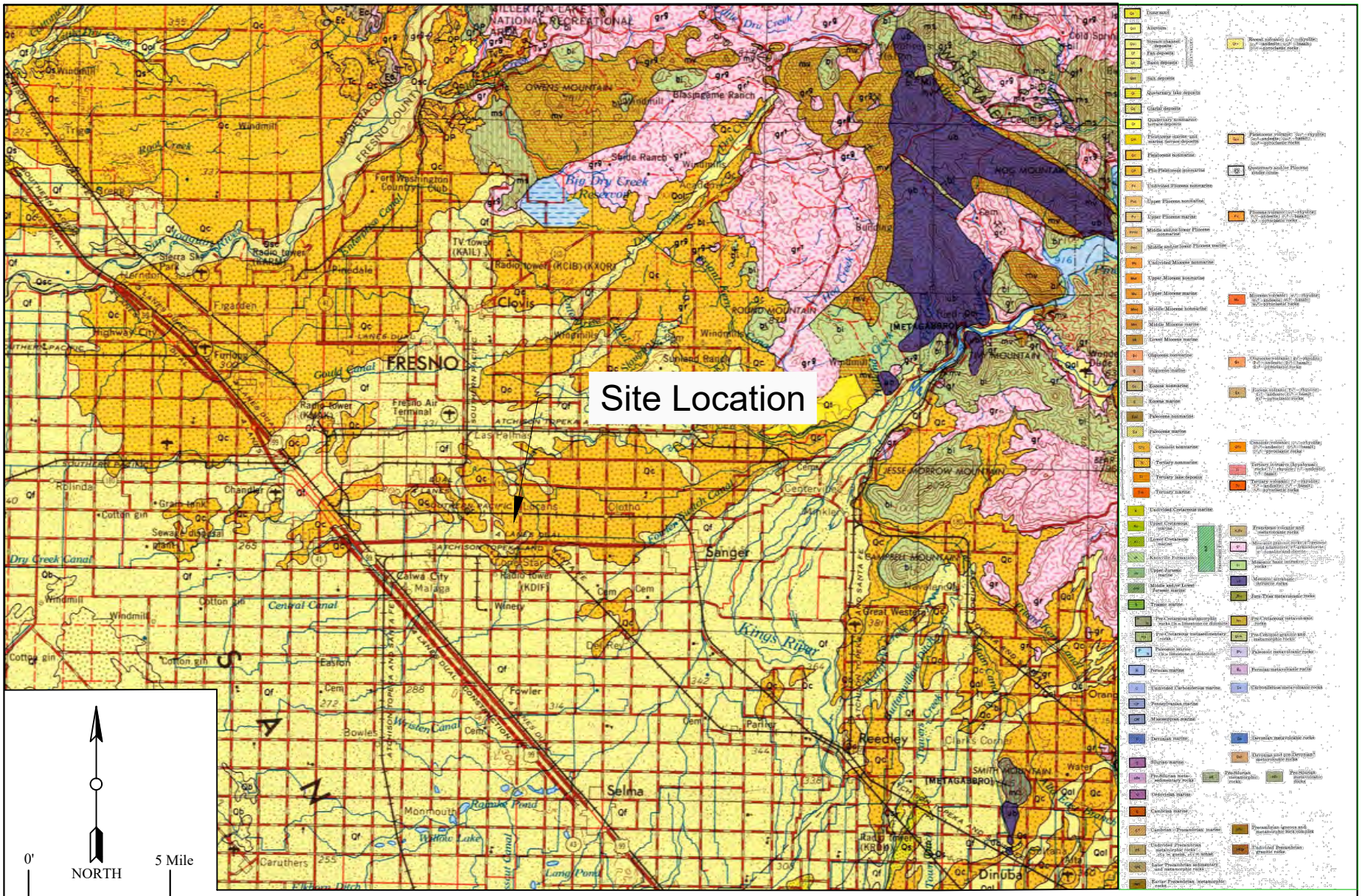

Malaga, CA. 2018 USGS 7.5' Topo

| | | | |
|---|---|---|---|
| VICINITY MAP | SCALE: 1 : 2500' | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR THE SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 1 | |



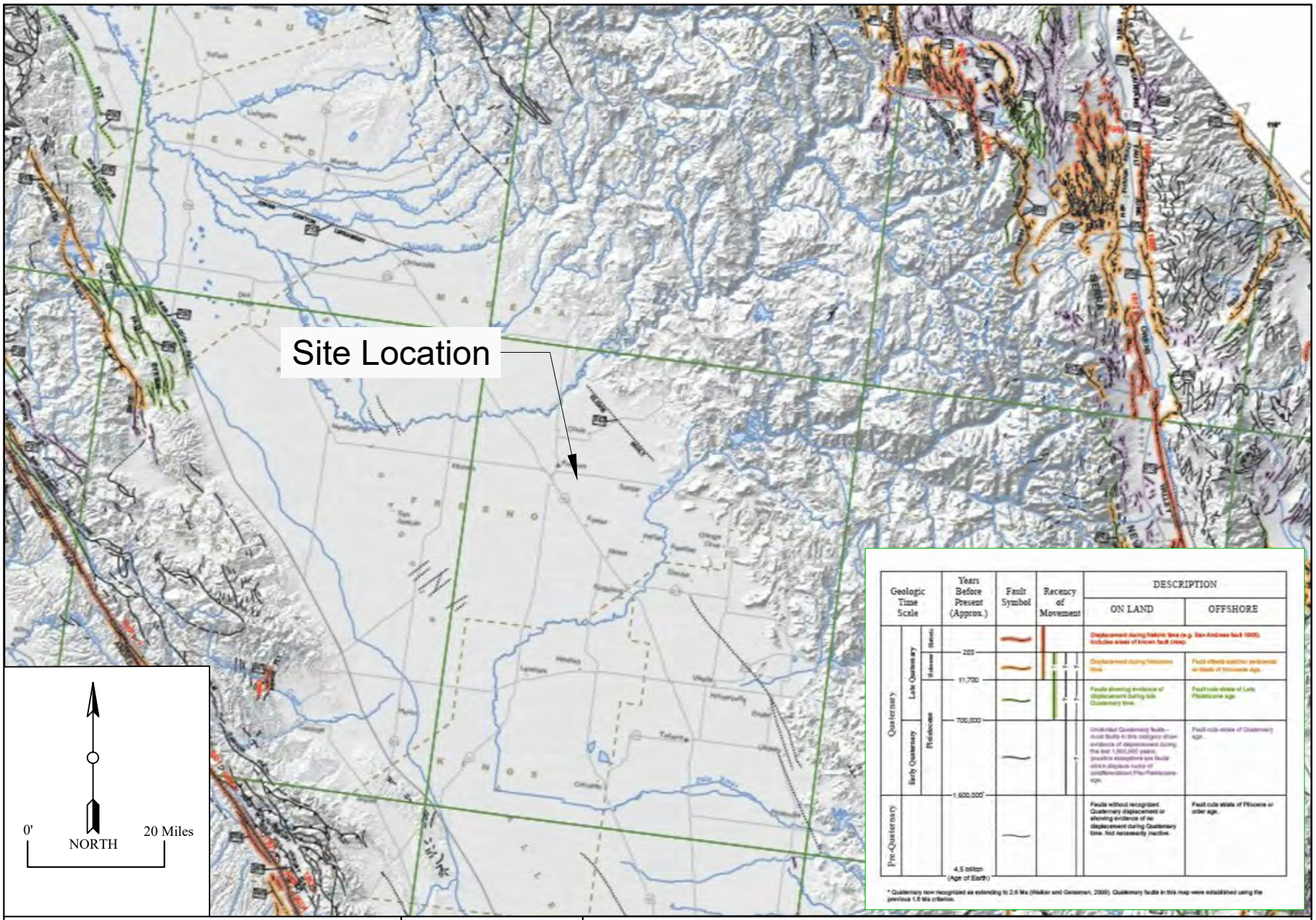

| | | |
|---|---|---|
| SITE PLAN | SCALE: 1"=100' | DATE: Sept 2020 |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 2 |

SALEM engineering group, inc.




**GEOLOGIC MAP OF CALIFORNIA OLAF P. JENKINS Ed. FRESNO SHEET COMPILATION BY ROBERT A. MATTHEWS AND JOHN L. BURNETT, 1965**

| | | | |
|---|---|---|---|
| REGIONAL GEOLOGIC MAP | SCALE: 1"= 5 Mile | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR THE SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 3 | |

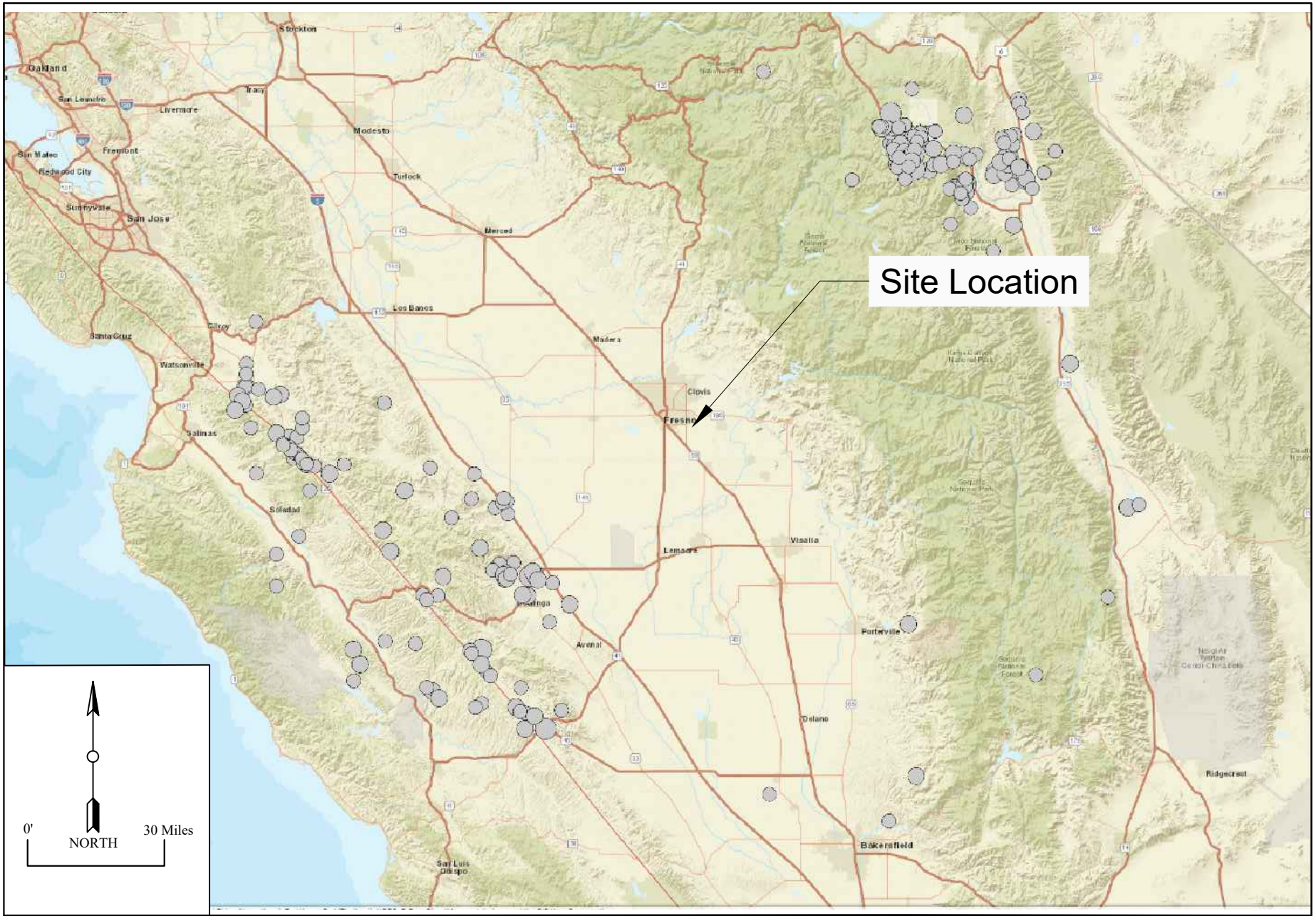



# FAULT LOCATION MAP

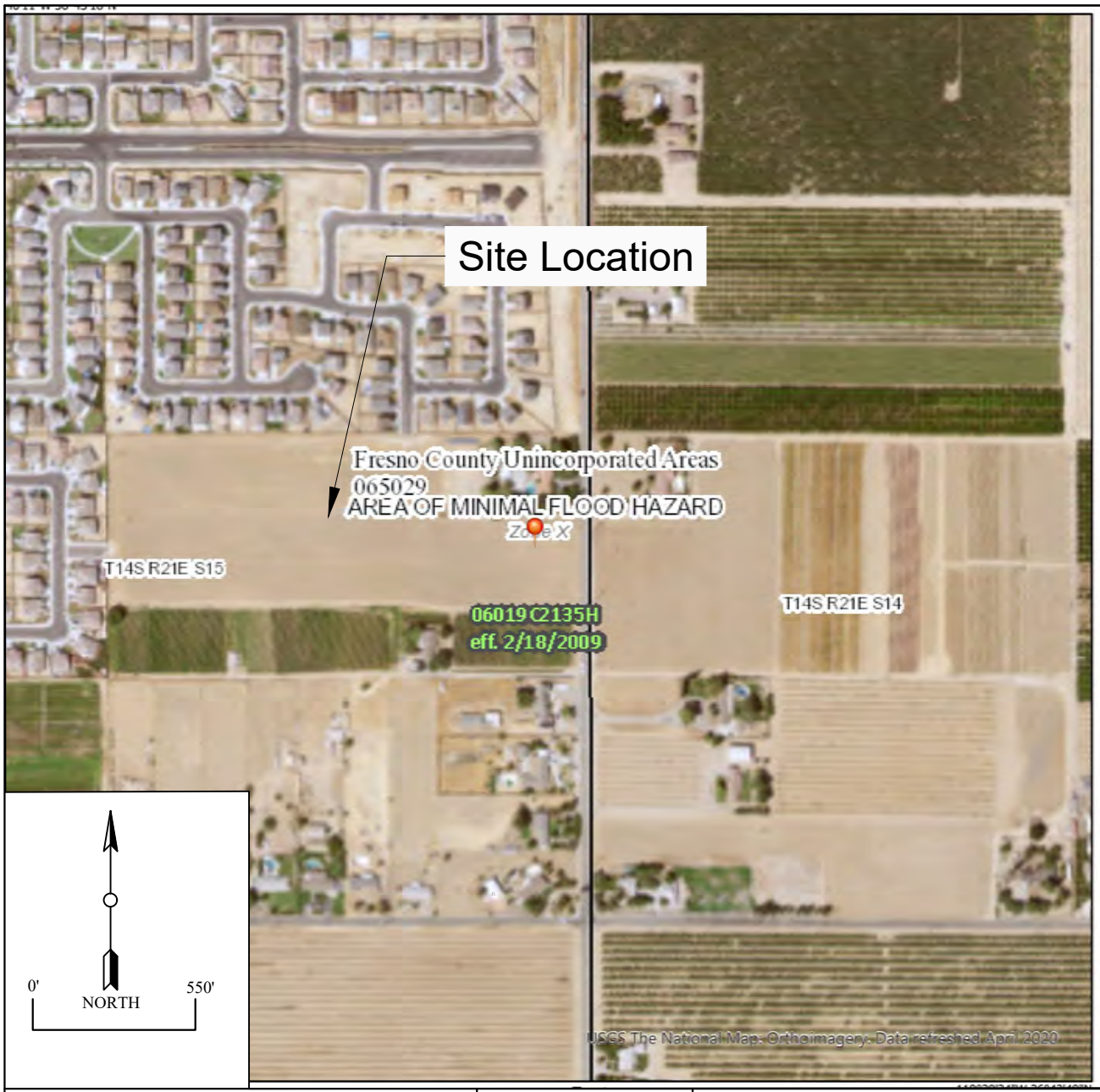
PROPOSED TEMPERANCE ELEMENTARY SCHOOL
NEAR THE SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE
FRESNO, CALIFORNIA

| | |
|---|---|
| SCALE1"=20 Miles | DATE: Sept 2020 |
| DRAWN BY: VT | APPROVED BY: DL |
| PROJECT NO. 1-220-0695 | FIGURE NO. 4 |

SALEM
engineering group, inc.




| | | | |
|---|---|---|---|
| EARTHQUAKE EPICENTER LOCATION MAP | SCALE: 1"= 30 Miles | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR THE SW CORNER OF E. CALIFORNIA & TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 5 | |




SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/8/2020 at 1:07 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for

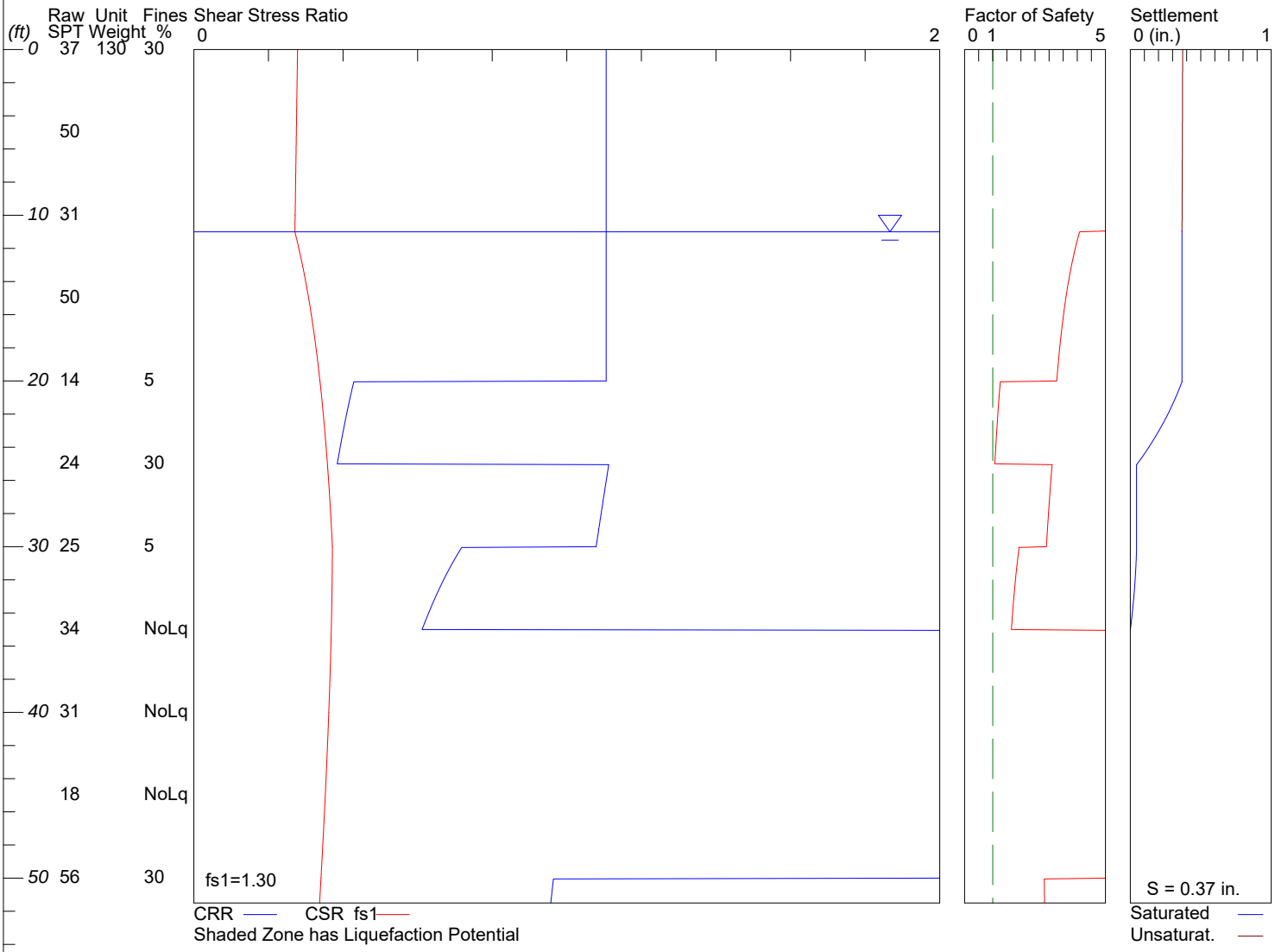
| | | | |
|---|---|---|---|
| FLOOD ZONE MAP | SCALE: 1"= 550' | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR THE SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUIE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 6 | |

# LIQUEFACTION ANALYSIS

## Proposed Temperance Elementary School

***Hole No.=B-12  Water Depth=11 ft***

***Magnitude=5.5***
***Acceleration=0.329g***



**********

LIQUEFACTION ANALYSIS SUMMARY



www.civiltech.com

**********

Title: Proposed Temperance Elementary School

Hole No.=B-12
Depth of Hole= 51.50 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration= 0.33 g
Earthquake Magnitude= 5.50

Input Data:

Hole No.=B-12
Depth of Hole=51.50 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration=0.33 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No

* Recommended Options

In-Situ Test Data:

| Depth ft | SPT | gamma pcf | Fines % |
|---|---|---|---|
| 0.00 | 37.00 | 130.00 | 30.00 |
| 5.00 | 50.00 | 130.00 | 30.00 |
| 10.00 | 31.00 | 130.00 | 30.00 |
| 15.00 | 50.00 | 130.00 | 30.00 |
| 20.00 | 14.00 | 130.00 | 5.00 |
| 25.00 | 24.00 | 130.00 | 30.00 |
| 30.00 | 25.00 | 130.00 | 5.00 |
| 35.00 | 34.00 | 130.00 | NoLiq |
| 40.00 | 31.00 | 130.00 | NoLiq |
| 45.00 | 18.00 | 130.00 | NoLiq |
| 50.00 | 56.00 | 130.00 | 30.00 |

Output Results:

Settlement of Saturated Sands=0.37 in.
Settlement of Unsaturated Sands=0.00 in.
Total Settlement of Saturated and Unsaturated Sands=0.37 in.

| Depth ft | CRRm | CSRfs | F.S. | S_sat. in. | S_dry in. | S_all in. |
|---|---|---|---|---|---|---|
| 0.00 | 1.11 | 0.28 | 5.00 | 0.37 | 0.00 | 0.37 |
| 1.00 | 1.11 | 0.28 | 5.00 | 0.37 | 0.00 | 0.37 |
| 2.00 | 1.11 | 0.28 | 5.00 | 0.37 | 0.00 | 0.37 |
| 3.00 | 1.11 | 0.28 | 5.00 | 0.37 | 0.00 | 0.37 |
| 4.00 | 1.11 | 0.28 | 5.00 | 0.37 | 0.00 | 0.37 |
| 5.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 6.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 7.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 8.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 9.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 10.00 | 1.11 | 0.27 | 5.00 | 0.37 | 0.00 | 0.37 |
| 11.00 | 1.11 | 0.27 | 4.08 | 0.37 | 0.00 | 0.37 |
| 12.00 | 1.11 | 0.28 | 3.93 | 0.37 | 0.00 | 0.37 |
| 13.00 | 1.11 | 0.29 | 3.80 | 0.37 | 0.00 | 0.37 |
| 14.00 | 1.11 | 0.30 | 3.69 | 0.37 | 0.00 | 0.37 |
| 15.00 | 1.11 | 0.31 | 3.59 | 0.37 | 0.00 | 0.37 |
| 16.00 | 1.11 | 0.31 | 3.51 | 0.37 | 0.00 | 0.37 |
| 17.00 | 1.11 | 0.32 | 3.44 | 0.37 | 0.00 | 0.37 |
| 18.00 | 1.11 | 0.33 | 3.38 | 0.37 | 0.00 | 0.37 |
| 19.00 | 1.11 | 0.33 | 3.32 | 0.37 | 0.00 | 0.37 |
| 20.00 | 1.11 | 0.34 | 3.27 | 0.37 | 0.00 | 0.37 |
| 21.00 | 0.42 | 0.34 | 1.22 | 0.32 | 0.00 | 0.32 |
| 22.00 | 0.41 | 0.35 | 1.18 | 0.27 | 0.00 | 0.27 |
| 23.00 | 0.40 | 0.35 | 1.14 | 0.20 | 0.00 | 0.20 |
| 24.00 | 0.39 | 0.35 | 1.11 | 0.13 | 0.00 | 0.13 |
| 25.00 | 0.38 | 0.36 | 1.07 | 0.05 | 0.00 | 0.05 |
| 26.00 | 1.11 | 0.36 | 3.06 | 0.04 | 0.00 | 0.04 |
| 27.00 | 1.10 | 0.36 | 3.02 | 0.04 | 0.00 | 0.04 |
| 28.00 | 1.09 | 0.37 | 2.98 | 0.04 | 0.00 | 0.04 |
| 29.00 | 1.09 | 0.37 | 2.94 | 0.04 | 0.00 | 0.04 |
| 30.00 | 1.08 | 0.37 | 2.90 | 0.04 | 0.00 | 0.04 |
| 31.00 | 0.69 | 0.37 | 1.87 | 0.04 | 0.00 | 0.04 |
| 32.00 | 0.67 | 0.37 | 1.81 | 0.03 | 0.00 | 0.03 |
| 33.00 | 0.65 | 0.37 | 1.75 | 0.03 | 0.00 | 0.03 |
| 34.00 | 0.63 | 0.37 | 1.70 | 0.01 | 0.00 | 0.01 |
| 35.00 | 0.61 | 0.37 | 1.66 | 0.00 | 0.00 | 0.00 |
| 36.00 | 2.00 | 0.37 | 5.00 | 0.00 | 0.00 | 0.00 |
| 37.00 | 2.00 | 0.37 | 5.00 | 0.00 | 0.00 | 0.00 |
| 38.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 39.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 40.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 41.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 42.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 43.00 | 2.00 | 0.36 | 5.00 | 0.00 | 0.00 | 0.00 |
| 44.00 | 2.00 | 0.35 | 5.00 | 0.00 | 0.00 | 0.00 |
| 45.00 | 2.00 | 0.35 | 5.00 | 0.00 | 0.00 | 0.00 |
| 46.00 | 2.00 | 0.35 | 5.00 | 0.00 | 0.00 | 0.00 |
| 47.00 | 2.00 | 0.35 | 5.00 | 0.00 | 0.00 | 0.00 |
| 48.00 | 2.00 | 0.35 | 5.00 | 0.00 | 0.00 | 0.00 |
| 49.00 | 2.00 | 0.34 | 5.00 | 0.00 | 0.00 | 0.00 |
| 50.00 | 2.00 | 0.34 | 5.00 | 0.00 | 0.00 | 0.00 |
| 51.00 | 0.96 | 0.34 | 2.84 | 0.00 | 0.00 | 0.00 |

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

| | |
|---|---|
| 1 atm (atmosphere) = 1 tsf (ton/ft2) | |
| CRRm | Cyclic resistance ratio from soils |
| CSRsf | Cyclic stress ratio induced by a given earthquake (with user request factor of safety) |
| F.S. | Factor of Safety against liquefaction, F.S.=CRRm/CSRsf |
| S_sat | Settlement from saturated sands |
| S_dry | Settlement from Unsaturated Sands |
| S_all | Total Settlement from Saturated and Unsaturated Sands |
| NoLiq | No-Liquefy Soils |

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM
engineering group, inc.

# GEOTECHNICAL ENGINEERING INVESTIGATION WITH GEOLOGIC HAZARDS EVALUATION

**SUPPLEMENTAL**
**GEOTECHNICAL ENGINEERING INVESTIGATION**
**PROPOSED CMU WALL, PLAYCOURTS, BACKSTOPS, AND**
**SUPPLEMENTAL PERCOLATION TESTING FOR THE**
**PROPOSED TEMPERANCE ELEMENTARY SCHOOL CAMPUS**
**SOUTHWEST OF EAST CALIFORNIA**
**AND SOUTH TEMPERANCE AVENUE**
**FRESNO COUNTY, CALIFORNIA**

**SALEM PROJECT NO. 1-220-0695**
**MAY 10, 2021**

***PREPARED FOR:***

**MR. RYAN KILBY**
**SANGER UNIFIED SCHOOL DISTRICT**
**1905 7TH STREET**
**SANGER, CA 93722**

***PREPARED BY:***

**SALEM ENGINEERING GROUP, INC.**
**4729 W. JACQUELYN AVENUE**
**FRESNO, CA 93722**
**P: (559) 271-9700**
**F: (559) 275-0827**
**www.salem.net**

SALEM
engineering group, inc.

**4729 W. Jacquelyn Avenue**
**Fresno, CA 93722**
**Phone (559) 271-9700**
**Fax (559) 275-0827**

May 10, 2021 Project No. 1-220-0695

Mr. Ryan Kilby
**Sanger Unified School District**
1905 7th Street
Sanger, California 93722

**Subject:** **SUPPLEMENTAL GEOTECHNICAL ENGINEERING INVESTIGATION**
Proposed CMU Wall, Playcourts, Backstops and Supplemental Percolation Testing
Proposed Temperance Elementary School Campus
Southwest of East California and South Temperance Avenue
Fresno County, California

**Reference:** Report of Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation, entitled Proposed Temperance Elementary School Campus, Sanger Unified School District, dated September 29, 2020, Prepared by SALEM Engineering Group

Dear Mr. Kilby:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Supplemental Geotechnical Engineering Investigation for the proposed Temperance Elementary School located southwest of East California and South Temperance Avenue in Fresno, Fresno County, California. This report addresses the proposed CMU wall foundations for the service yard area, play courts, and baseball/softball backstops, and supplements the above referenced report.

The accompanying supplemental report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (559) 271-9700.

Respectfully Submitted,

**SALEM ENGINEERING GROUP, INC.**

Ken Clark, CEG
Senior Engineering Geologist
CEG 1864

Dean B. Ledgerwood II, EIT, PG, CEG
Geotechnical Manager
PG 8725 / CEG 2613

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SALEM
engineering group, inc.

4729 W. Jacquelyn Avenue
Fresno, CA 93722
Phone (559) 271-9700
Fax (559) 275-0827

# SUPPLEMENTAL GEOTECHNICAL ENGINEERING INVESTIGATION PROPOSED CMU WALL, PLAYCOURTS, BACKSTOPS, AND SUPPLEMENTAL PERCOLATION TESTING FOR THE PROPOSED TEMPERANCE ELEMENTARY SCHOOL CAMPUS SOUTHWEST OF EAST CALIFORNIA AND SOUTH TEMPERANCE AVENUE FRESNO COUNTY, CALIFORNIA

## 1. BACKGROUND, PURPOSE AND SCOPE

Temperance Elementary School is to be located southwest of East California and South Temperance Avenue in Fresno, Fresno County, California. SALEM Engineering Group conducted a field investigation in September 2020 for buildings and other proposed improvements in the west portion of the proposed campus site and prepared the referenced Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation report, dated September 29, 2020.

The purpose of this Supplemental Geotechnical Engineering Investigation was to conduct site observations, observe and sample the subsurface conditions (primarily in the central and east portions of the site), conduct percolation testing, and to provide conclusions and recommendations relative to geotechnical design and construction of CMU wall foundations for the service yard area, pile foundations for the baseball/softball backstops, netting, foul poles, and lighting, and play courts at the proposed school site. In addition, this report presents the results of percolation testing.

This supplemental report is not a stand-alone document and should be used in conjunction with the referenced report of Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation. The recommendations presented herein are based on the proposed site improvements (see Figure 2) and our analysis of the data obtained during our recent field investigation, and review of data obtained as part of the field investigation for the referenced report, conducted in 2020. The geologic-seismic hazards evaluations contained in the above referenced report should be considered applicable to the subject improvements of this supplemental report.

If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If the text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report take precedence.

It should be noted that this report does not include recommendations for building foundations or slabs, which are proposed in the west portion of the site, nor does this report address pavement design, utilities, or temporary excavations. Applicable geotechnical recommendations pertaining to these proposed improvements are provided in the referenced report of Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation.

## 2. SITE LOCATION AND DESCRIPTION

The proposed elementary school campus and the improvement specific to this report are planned within a mostly vacant field southwest of the intersection of East California and South Temperance Avenue in Fresno, Fresno County, California (see the Vicinity Map, Figure 1 at the end of this report). He proposed CMU walls, play courts and referenced play field improvements are primarily located near the eastern extent of our field investigation conducted 2020.

At the time of our field investigation, the project site area was essentially level and an existing abandoned single family residence building and landscaping (including several mature trees) were noted in the southeast portion of the site. The ground surface at the site was covered with short green and dry native grasses and weeds. Much of the site appeared to have been disced prior to the recent vegetation growth.

Google Earth imagery indicates the site lies at an elevation of about 322 feet above mean sea level.

## 3. PROJECT DESCRIPTION

Our understanding of the project is based on correspondence with SIMPBK and a preliminary site plan prepared by SIMPBK and provided on February 11, 2021. We understand that the project involves the construction of CMU wall foundations for the service yard area, play courts, and baseball/softball backstops. These proposed improvements are located east of the proposed campus buildings, as shown on Figure 2, Site Plan.

A maximum wall load of 1,500 pounds per linear foot and maximum total and differential settlements of 1 inch and ½ inch, respectively, are anticipated for the CMU wall foundations.

A site grading plan was not available at the time of preparation of this report. As the existing project area is essentially level, we anticipate that cuts and fills during earthwork to achieve finished grades will be minimal (about 1 to 2 feet). In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified.

## 4. FIELD EXPLORATION

### 4.1 Drilling Test Boring

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-13 through B-18), percolation test holes (P-1 though P-4), and R-value sample holes (R-1 and R-2) were drilled on April 2, 2021 at the approximate locations shown on the Site Plan, Figure 2. The holes were drilled to depths of 5 to 31½ feet below site grade (BSG) using 6-5/8-inch diameter hollow-stem auger powered by a truck-mounted CME-55 drill rig. The location of the soil borings are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation and exploratory boring logs are presented in Appendix A. Discussion of the percolation test holes and testing is provided in Section 6.4 of this report.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer, and stratification lines were approximated on the basis of observations made at the time

of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The test boring logs are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted.

Soil samples were obtained from the test borings at the depths shown on the test boring logs. The samples recovered were capped at both ends to preserve the samples at their natural moisture content; bag samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

The locations of the test borings and percolation test holes were determined by measuring from features shown on the Site Plan provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

### 4.2 Percolation Testing

Plans for on-site storm water infiltration were not available at the time of this report. Shallow percolation testing was conducted at four (4) non-building locations located across the campus site. The approximate locations of the percolation tests are shown on the attached Figure 2.

The percolation test holes were drilled to depths of 36 to 48 inches BSG using the truck-mounted drill rig and were approximately 6-5/8 inches in diameter. Approximately 2 inches of gravel was placed in the bottom of each hole followed by a 3-inch diameter perforated pipe. The annulus surrounding the perforated pipe was backfilled with gravel. The test holes were pre-saturated overnight before commencement of percolation testing. The percolation tests were conducted in soils identified as silty sands. The percolation test logs are included in Appendix A of this report and the results of the percolation testing are provided in Section 6.4 of this report.

## 5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, consolidation potential, resistivity, R-value, and gradation of the soil materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and laboratory test results are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

## 6. SOIL AND GROUNDWATER CONDITIONS

### 6.1 Subsurface Conditions

The subsurface soil conditions encountered appear typical of those found in the geologic region of the site. In general, the soils encountered in the test borings drilled consisted of primarily near surface silty sands underlain by interbedded layers of clayey sand, poorly graded sand, poorly graded sand with silt, and silty

sand to the maximum depth explored of 31.5 feet BSG. Cemented soils, locally referred to as 'hardpan' were encountered at depths as shallow as about 1 feet BSG. The hardpan soils were noted to extend to depths ranging from 5 to 15 feet BSG.

A direct shear test conducted on a sample collected from a depth at 25 feet BSG resulted in an internal angle of friction of 47 degrees with a cohesion value of 130 pound square foot.

The results of R-value testing performed on near surface samples resulted in R-values of 60 and 62.

An expansion index test performed on a near surface soil sample collected for our previous investigation of the site resulted in an expansion index of 2.

Soil conditions described in the previous paragraphs are generalized. Therefore, the reader should consult exploratory boring logs included in Appendix A for soil type, color, moisture, consistency, and USCS classification of the materials encountered at specific locations and elevations.

### 6.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was not encountered within the depth of exploration, 31.5 feet BSG. Seasonal perched water conditions may occur due to the shallow depth to hardpan encountered.

Based on review of well data provided on the Department of Water Resources Water Data Library website (https://wdl.water.ca.gov/), State Well Number 367217N1196466W001 located 1.2 miles northeast of the project site, reported a historical high groundwater depth of 11.2 feet BSG in April 1922.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

### 6.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride. The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be less than 50 mg/kg.

ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 6.3 below.

**TABLE 6.3**
**WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS**

| Water Soluble Sulfate ($SO_4$) in Soil, Percentage by Weight | Exposure Severity | Exposure Class | Maximum w/cm Ratio | Minimum Concrete Compressive Strength | Cementations Materials Type |
|---|---|---|---|---|---|
| 0.0187 | Not Applicable | S0 | N/A | 2,500 psi | No Restriction |

The water-soluble chloride concentration detected in saturation extract from the soil samples was 66 mg/kg. In addition, testing performed on a near surface soil resulted in a minimum resistivity value of 4,645 ohm-centimeter. Based on the results, these soils would be considered to have a "Corrosive" potential to buried metal objects (per National Association of Corrosion Engineers, Corrosion Severity Ratings)

It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed. Additional corrosion testing for minimum resistivity may need to be performed if required by the pipe manufacturer.

### 6.4 Results of Percolation Testing

Four (4) percolation tests were performed in the near surface silty sand soils at the approximate locations shown on Figure 2. The percolation test hole construction is described in Section 4.2 of this report. The following table includes a summary of the test results.

**TABLE 6.4**
**SUMMARY OF PERCOLATION TEST RESULTS**

| Location | Approx. Bottom of Test Hole Depth, BSG (Inches) | Soil Classification | Gravel Pack Corrected Estimated Unfactored Percolation Rate (minutes per inch)* | Estimated Unfactored Infiltration Rate (inches/hour) * |
|---|---|---|---|---|
| P-1 | 48 | Silty Sand | 31.9 | 0.18 |
| P-2 | 48 | Silty Sand | 159.3 | 0.04 |
| P-3 | 36 | Silty Sand | 95.6 | 0.10 |
| P-4 | 42 | Silty Sand | 53.1 | 0.20 |

*Rounded to nearest 1/10.

Based on the results of the percolation testing, estimated unfactored infiltration rates of 0.04 to 0.20 inches per hour were calculated. These estimated infiltration rates are considered very low and do not take into account the long term effects of subgrade saturation, silt accumulation, groundwater influence, nor vegetation. Soil bed consolidation, sediment, suspended soils, etc. in the discharge water can result in clogging of the pore spaces in the soil, thus reducing the soil infiltration rate over time. A safety factor ranging from 3 to 10 is

generally recommended to be applied to the unfactored infiltration rates. Considering the estimated range of factored infiltration rates for the project, on-site infiltration of storm water to the near surface soils is not considered feasible for the proposed campus.

## 7. GENERAL GEOLOGIC CONDITIONS

### 7.1 Geologic Setting

The project site is in San Joaquin Valley, which is a topographic and structural basin that is bounded on the east by the Sierra Nevada geomorphic province and on the west by the Coast Ranges geomorphic province. The San Joaquin (Great Valley Geomorphic Province) is an alluvial plain about 50 miles wide and 400 miles long in the central part of California (California Geologic Survey (CGS) Note 36). The Great Valley is an elongated trough in which sediments have been deposited almost continuously for the last approximately 160 million years (Jurassic). The Great Valley reaches depths of about 30,000 feet at its southern end, and is filled with a large volume of sediments of Mesozoic through Recent age. Recent alluvium covers nearly the entire valley floor, and has largely been derived from the adjacent Sierra Nevada except in the westernmost portions of the valley floor.

The subject site is mapped by the CGS (Fresno Geologic Sheet[1]) as underlain by Pleistocene age Non-marine deposits (Qc). The sediments in the project area exposed during our recent subsurface exploration indicate the near surface soils predominantly consist of silty sand with varying amounts of cementation.

The site is not located within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards and no known active faults are located within the site area. The Nunez fault is the closest active fault with the potential for surface rupture, located 56 miles southwest of the subject site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

The site is located in an area potentially subject to moderate seismic ground shaking. Based on Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, the estimated design peak seismic ground acceleration adjusted for site class effects ($PGA_M$) was determined to be 0.329 g (based on both probabilistic and deterministic seismic ground motion).

The referenced report entitled "Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation," dated September 29, 2020, indicated a calculated design total seismic induced settlement of about ½ inch and a differential seismic settlement of about ¼ inch in 40 feet. These values are applicable for design of foundations for the proposed improvements.

The referenced Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation report should be referred to for additional geologic and seismic hazards information for the site.

[1] Matthews, R.A., and Burnett, J.L., 1965, Geologic map of California : Fresno sheet: California Division of Mines and Geology, scale 1:250,000

## 8. CONCLUSIONS AND RECOMMENDATIONS

### 8.1 General

8.1.1 Based upon the data collected during this investigation and our review of the referenced report entitled "Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation," dated September 29, 2020, from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed improvements provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing programs, and our understanding of the proposed development at this time.

8.1.2 The soils encountered during the field exploration, primarily consisted of near surface silty sands underlain by interbedded layers of clayey sand, poorly graded sand, poorly graded sand with silt, and silty sand to the maximum depth explored of 31.5 feet BSG. Cemented soils, locally referred to as 'hardpan' were encountered at depths as shallow as about 1 feet BSG. The hardpan soils were noted to extend to depths ranging from 5 to 15 feet BSG.

8.1.3 The near surface soils have high compressibility characteristics and high collapse potential. Based on the granular nature of the soils encountered and laboratory testing conducted for the referenced Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation report, the upper soils have a very low expansive potential (EI=2). When compacted as engineered fill, the near surface soils have excellent pavement support characteristics.

8.1.4 Considering the estimated range of factored infiltration rates based on the field percolation test rates and relatively shallow depth to low permeable cemented hardpan soils, on-site infiltration of storm water to the near surface soils is not considered feasible for the proposed campus.

8.1.5 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed improvements may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

8.1.6 Provided the site is graded in accordance with the recommendations of this report, and foundations constructed as described herein, we estimate that total settlement due to static loads utilizing conventional shallow foundations of about 1-inch and corresponding differential static of ½ inch in 40 feet.

8.1.7 Total and differential seismic settlements on the order of ½ inch and ¼ inch in 40 feet, respectively, should be considered for design.

8.1.8 Based on the chemistry testing performed, the near surface soils have 'negligible' potential for sulfate attack on concrete and are considered to be "corrosive" to buried metal objects.

8.1.9 All references to relative compaction and optimum moisture content in this report are based on ASTM D 1557 (latest edition).

8.1.10 SALEM should be retained to review the project plans as they develop further, provide engineering consultation as-needed, and perform geotechnical observation and testing services during construction.

## 8.2 Surface Drainage

8.2.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause soil to lose internal shear strength and increase its compressibility, resulting in adverse change to important engineering properties. Proper drainage should be maintained at all times.

8.2.2 The ground immediately adjacent to foundations shall be sloped away from the foundations at a slope of not less than 5 percent for a minimum distance of 10 feet. Impervious surfaces within 10 feet of foundations shall be sloped a minimum of 2 percent away from the structures and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structures. Over-irrigation within landscaped areas adjacent to the structures should not be performed.

## 8.3 Site Grading

8.3.1 A representative of our firm should be present during all site clearing and grading operations to test and/or observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

8.3.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

8.3.3 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, undocumented fill, underground buried structures, and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. After demolition activities, it is recommended that disturbed soils be removed and/or replaced with compacted engineered fill soils.

8.3.4 Site preparation for all proposed improvement area should begin with removal of existing surface/subsurface structures, underground utilities (as required), disturbed soil, any existing uncertified/undocumented fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report. Any disturbed subgrade, undocumented fill materials or loose unsuitable materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the over-excavation should be determined by our field representative during construction

8.3.5 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

8.3.6 Removal of the trees in the area of the on-site residence and associated disturbed soils from existing site conditions will be an integral part of the site preparation. Existing trees should be removed and their root systems should be thoroughly cleared of root balls as well as isolated roots greater than ¼-inch in diameter. The root system removal may disturb a significant quantity of soil. Following tree removal, all loose and disturbed soil should be removed from the tree wells. Any areas or pockets of soft or loose soils, void spaces made by burrowing animals, undocumented fill, or other disturbed soil (i.e. soil disturbed by root removal) that are encountered, should be excavated to expose approved firm native material. Care should be taken during site grading to mitigate (e.g. excavate and compact as engineered fill) all soil disturbed by demolition and tree removal activities

8.3.7 The over-build zone for the CMU wall foundations should be considered as areas extending a minimum of 3 feet horizontally beyond the outside dimensions of buildings, including footings and non-cantilevered overhangs carrying structural loads.

8.3.8 To provide uniform support for the proposed CMU wall foundations, it is recommended that over-excavation extend to at least 24 inches below preconstruction site grade, 12 inches below foundations, or to the depth required to remove any undocumented fills. The resulting bottom of excavation shall be scarified to a minimum depth of at least 12 inches, worked until uniform and free from large clods, moisture conditioned to slightly above optimum moisture, and compacted to 92 percent of the maximum density. The horizontal limits of the over-excavation should extend throughout the foundation area, extending laterally to a minimum of 3 feet beyond the outer edges of the proposed footings. The resulting bottom of excavation shall be scarified to a minimum depth of at least 8 inches, worked until uniform and free from large clods, moisture-conditioned to slightly above optimum moisture, and compacted to a minimum of 92 percent of the maximum density.

8.3.9 Areas of asphaltic concrete covered playcourts (located outside building pad over-build zones), should be prepared by over-excavation to 12 inches below preconstruction site grade or 12 inches below bottom of proposed aggregate base section, whichever provides greater fill. The zone of subgrade preparation should extend a minimum of 3 feet beyond these improvements. The resulting bottom of excavation shall be scarified to a minimum depth of at least 8 inches, worked until uniform and free from large clods, moisture-conditioned to slightly above optimum moisture, and compacted to a minimum of 92 percent of the maximum density (except where playcourt areas will accommodate vehicular traffic loads where the minimum compact requirement should be 95 percent of the maximum density).

Asphaltic concrete playcourt areas which will accommodate vehicular traffic loads should be supported on a minimum of 4 inches of Class 2 aggregate base compacted to 95 percent relative compaction over subgrade soils prepared as recommended above. In the event that playcourts are not designed for vehicular traffic loads, playcourts may be supported directly over compacted subgrade soils as recommended above. However, it should be noted that vehicular traffic on playcourts not designed for traffic loads could result in playcourt distress (cracking, rutting, etc.)

8.3.10 At a minimum, areas to receive engineered fill should be prepared by scarification of the upper 12 inches below existing grade or 12 inches below the recommended base section, whichever is greater. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.

8.3.11 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

8.3.12 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

8.3.13 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier months of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties. Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

8.3.14 Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation. To expedite the stabilizing process, crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose.

If the use of crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of ¾-inch to 1-inch crushed rocks. The thickness of the rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. All open graded crushed rock/gravel should be fully encapsulated with a geotextile fabric (such as Mirafi 140N) to minimize migration of soil particles into the voids of the crushed rock. Although it is not required, the use of geogrid (e.g. Tensar BX 1100, BX 1200 or TX 160) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization.

Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

## 8.4 Soil and Excavation Characteristics

8.4.1 Based on the soil conditions encountered in our borings, the near surface soils can be excavated with moderate difficulty with conventional excavation equipment (backhoes, excavators, scapers, augers for drilled piles, etc.). As noted, hardpan soils were encountered at depths greater than about 1 foot BSG. The contractor should anticipate increased excavation effort will be required for the hardpan soils. In addition, hardpan fragments will require processing and blending with on-site soils prior to use as engineered fill.

8.4.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements. Temporary excavations are further discussed in a later Section of this report.

8.4.3 The near surface soils identified as part of our investigation are, generally, damp to moist due to the absorption characteristics of the soil. Seasonal perched water conditions may occur due to the shallow depth to hardpan encountered. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

## 8.5 Materials for Fill

8.5.1 On-site soils are suitable for use as general Engineered Fill, provided they do not contain deleterious matter, organic material, or rock/cemented hardpan fragments material larger than 3 inches in maximum dimension. The resultant engineered fill material should be well graded to a uniform mixture to prevent nesting of large particles.

8.5.2 Imported Non-Expansive Engineered Fill soil, should be well-graded, very low-to-non-expansive slightly cohesive silty sand or sandy silt. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 8.5.2.

**TABLE 8.5.2**
**IMPORT FILL REQUIREMENTS**

| | |
|---|---|
| Percent Passing 3-inch Sieve | 100 |
| Percent Passing No.4 Sieve | 75-100 |
| Percent Passing No 200 Sieve | 15-40 |
| Maximum Plasticity Index | 15 |
| Maximum Organic Content | 3% by Weight |
| Maximum Expansion Index (ASTM D4829) | 20 |

Prior to importing fill, the Contractor shall submit test data that demonstrates that the proposed import complies with the recommended criteria for both geotechnical and environmental compliance. Also, prior to being transported to the site, the import material shall be certified by the Contractor and the supplier (to the satisfaction of the School District) that the soils do not contain any environmental contaminates regulated by local, state or federal agencies having jurisdiction. This certification shall consist of, as a minimum, analytical data specific to the source of the import material in accordance with the Department of Toxic Substances Control, "Informational Advisory, Clean Imported Fill Material," dated October 2001. The list of constituents to be tested for the fill source shall be submitted to SUSD for review and approval prior to the Contractor testing the fill. Contractors should provide a minimum of 14 working days after sample collection to complete the DTSC and geotechnical testing.

8.5.3 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in lifts no thicker than will allow for adequate bonding and compaction (typically 6 to 8 inches thickness measured loose).

8.5.4 On-site soils used as engineered fill soils should moisture conditioned to slightly above optimum moisture content, and compacted to at least 92 percent relative compaction.

8.5.5 Import Engineered Fill, if selected, should be placed, moisture conditioned to slightly above optimum moisture content, and compacted to at least 92 percent relative compaction.

8.5.6 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

8.5.7 Environmental characteristics and corrosion potential of import soil materials should also be considered.

8.5.8 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

8.5.9 Aggregate base material should meet the requirements of a Caltrans Class 2 Aggregate Base. The aggregate base material should conform to the requirements of Section 26 of the Standard Specifications for Class 2 material, ¾-inch or 1½-inches maximum size. The aggregate base material should be compacted to a minimum relative compaction of 95 percent based ASTM D1557. The aggregate base material should be spread in layers not exceeding 6 inches and each layer of aggregate material course should be tested and approved by the Soils Engineer prior to the placement of successive layers.

## 8.6 Seismic Design Criteria

8.6.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2019 CBC, our recommended parameters are shown below. These parameters are consistent with the values provided in the referenced 2020 Geotechnical Engineering Investigation with Geologic Seismic Hazards Evaluation report, and were determined using California's Office of Statewide Health Planning and Development (OSHPD) (https://seismicmaps.org/) in accordance with the 2019 CBC. The Site Class was determined based on the soils encountered during our field exploration. Based on our understanding of the project, the Structural Engineer will utilize code exceptions summarized under ASCE 7-16, 11.4.8. Therefore, a site specific ground motion hazard analysis is not required.

**TABLE 8.6.1**
**2019 CBC SEISMIC DESIGN PARAMETERS**

| Seismic Item | Symbol | Value | 2010 ASCE 7 or 2019 CBC Reference |
|---|---|---|---|
| Site Coordinates (Datum = NAD 83) | | 36.7180 Lat<br>-119.6670 Lon | |
| Site Class | -- | D | ASCE 7 Table 20.3 |
| Soil Profile Name | -- | Stiff Soil | ASCE 7 Table 20.3 |
| Risk Category | -- | III | CBC Table 1604.5 |
| Site Coefficient for PGA | $F_{PGA}$ | 1.358 | ASCE 7 Table 11.8-1 |
| Peak Ground Acceleration<br>(adjusted for Site Class effects) | $PGA_M$ | 0.329 g | ASCE 7 Equation 11.8-1 |
| Seismic Design Category | SDC | D | ASCE 7 Table 11.6-1 & 2 |
| Mapped Spectral Acceleration<br>(Short period - 0.2 sec) | $S_S$ | 0.559 g | CBC Figure 1613.2.1(1-6) |
| Mapped Spectral Acceleration<br>(1.0 sec. period) | $S_1$ | 0.220 g | CBC Figure 1613.3.1(1-6) |
| Site Class Modified Site Coefficient | $F_a$ | 1.353 | CBC Table 1613.3.3(1) |
| Site Class Modified Site Coefficient | $F_v$ | **2.160*** | CBC Table 1613.3.3(2) |
| MCE Spectral Response Acceleration<br>(Short period - 0.2 sec) $S_{MS} = F_a S_S$ | $S_{MS}$ | 0.756 g | CBC Equation 16-36 |
| MCE Spectral Response Acceleration<br>(1.0 sec. period) $S_{M1} = F_v S_1$ | $S_{M1}$ | **0.475 g*** | CBC Equation 16-37 |

| Seismic Item | Symbol | Value | 2010 ASCE 7 or 2019 CBC Reference |
|---|---|---|---|
| Design Spectral Response Acceleration $S_{DS}=⅔S_{MS}$ (short period - 0.2 sec) | $S_{DS}$ | 0.504 g | CBC Equation 16-38 |
| Design Spectral Response Acceleration $S_{D1}=⅔S_{M1}$ (1.0 sec. period) | $S_{D1}$ | **0.317 g*** | CBC Equation 16-39 |
| Short Period Transition Period ($S_{D1}/S_{DS}$), Seconds | $T_S$ | 0.629 | ASCE 7-16, Section 11.4.6 |
| Long Period Transition period (seconds) | $T_L$ | 12 | ASCE 7-16, Figures 22-14 through 22-17 |

**Note:** *** Determined per ASCE Table 11.4.8 for use in calculating $T_S$ only.**

**Site Specific Ground Motion Analysis was not included in the scope of this investigation. Per ASCE 11.1.48, Structures on Site Class D, with $S_1$ greater than or equal to 0.2 may require Site Specific Ground Motion Analysis. However, a site specific ground motion analysis may not be required based on Exceptions listed in ASCE 11.4.8. The Structural Engineer should verify whether exceptions summarized in ASCE 7-16, Section 11.4.8 is valid for the proposed construction. In the event a site specific ground motion analysis is required, SALEM should be contacted for these services.**

8.6.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

## 8.7 Shallow Foundations for CMU Walls

8.7.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings supported on engineered fill soils prepared in accordance with Section 8.3 of this report. Shallow foundations supported on engineered fill as recommended in this report may be designed based on total and differential static settlement of 1 inch and ½ inch in 40 feet, respectively.

8.7.2 The width and depth of foundations should be determined by the project Structural Engineer. At a minimum, CMU wall footings should have a width of 12 inches and extend to minimum depths of 12 inches below the lowest adjacent grade.

8.7.3 Footing concrete should be placed into neat excavation. The footing bottoms shall be maintained free of loose and disturbed soil.

8.7.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

| Loading Condition | Allowable Bearing |
|---|---|
| Dead-Plus-Live Load | 3,000 psf |
| Total Load, Including Wind or Seismic Loads | 3,990 psf |

8.7.5 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.39 acting between the base of foundations and the supporting engineered fill subgrade.

8.7.6 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 350 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination in Section 1605.3.2 of the 2019 CBC that includes wind or earthquake loads.

8.7.7 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

8.7.8 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

**8.8 Cast-in-Drilled-Hole Pile (CIDH) Foundation Design for Lighting, Netting, and Foul Poles**

8.8.1 A structural engineer registered in the state of California should prepare structural details for lighting, backstops, netting, and foul pole CIDH foundations to resist shear, moment, and axial (tension and compression) loads considering the recommendations of this report.

8.8.2 A structural engineer experienced in foundation design should recommend the thickness, design details and concrete specifications for the foundations based on a total static settlement of 1 inch and a differential static settlement of ½ inch between foundations.

8.8.3 Piles should be placed no closer than three pile diameters, center-to-center. For alternate spacing, the capacity of piles in groups should be reduced using appropriate group reduction formulas. Piles for lighting, netting, or foul poles should be drilled to a minimum of 6 feet below finished site grade.

8.8.4 Contractors should expect that pile drilling will encounter hardpan, which will be significantly more difficult to penetrate than the overlying soils.

8.8.5 The upper 1½ feet of soil, or to a depth of 1 pile diameter (whichever is greater) should be neglected for determining axial resistance and uplift. For deeper pile foundations (greater than 6 feet deep), below a depth of 1½ feet BSG, the allowable vertical downward load capacity of the CIDH pile foundations may be designed based on an allowable skin friction of 300 pounds per square foot. End bearing should be neglected. This value may be increased ⅓ for short duration loading. Section 8.8.9 should be referred to for short lighting poles and netting poles with foundations less than 6 feet deep.

8.8.6 The uplift resistance of the pile foundations may be determined based on a tension load capacity applied as skin friction of 150 pounds per square foot in soil below the neglect depth. The weight of the pile may also be used to resist uplift.

8.8.7 The passive pressure for drilled pile foundations spaced at a minimum of three (3) pile diameters, may be applied over a width equal to 2 pile diameters. For example, where a passive pressure of 300 pounds per cubic foot (equivalent fluid pressure) is recommended, a passive pressure of 600 pounds per cubic foot could be applied across the pile diameter.

8.8.8 Passive resistance should be neglected to a depth of upper 1½ feet below the ground surface at the pile, or to a depth providing a horizontal setback to a sloping ground surface of at least 6 feet, whichever is deeper. Below the neglect depth, a passive pressure of 300 pounds per cubic foot (equivalent fluid pressure), up to a maximum of 3,000 pounds per cubic foot may be used for design.

8.8.9 Short lighting poles and netting poles (with foundations less than 6 feet deep) may be supported on a cast-in-drilled-hole reinforced concrete foundation and lateral load resistance may be estimated using the CBC non-constrained procedure (CBC Section 1806.8.2.1). The allowable passive resistance of the native soils may be assumed to be equal to the pressure developed by a fluid with a density of 250 pounds per square foot per foot of depth to a maximum of 2,500 pounds per square foot. The upper neglect zone for passive pressure is given in Section 8.8.5.

## 8.9 Cast-In-Drilled-Hole Pile Construction

8.9.1 It is assumed the project structural engineer will prepare a specification for the construction of the cast-in-drilled hole foundations as part of the construction documents. The specifications should be consistent with the recommendations included in this report.

8.9.2 Concrete should be placed in the drilled shaft as soon as possible following drilling.

8.9.3 Casing (if used) should be able to withstand the external pressures of the caving soils. The outside diameter of the casing should not be less than the diameter of the cast-in-drilled hole concrete pile.

8.9.4 Drilled holes for pile foundations should be drilled within 2 degrees of vertical. The rebar cage should be suspended within 2 degrees of vertical in the center of the excavation. This condition should be verified and documented during construction. Minimum concrete cover, as specified by the project design engineer, should be maintained throughout the length of the excavation.

8.9.5 In the event freewater seepage is encountered during excavation, the concrete should be placed from the bottom of the excavation by extending the tremie pipe or pump pipe to the bottom of the excavation and maintaining the outlet of the pipe below the wet concrete to prevent entrapment of freewater or slurry in the concrete. The concrete should be placed in a continuous manner to provide a seamless deep foundation element.

8.9.6 Casing (if used) should be lifted slowly as the concrete is deposited, while the bottom of the casing is kept at least two feet below the top of the concrete.

8.9.7 SALEM should inspect the drilling of the shafts to verify that the materials encountered are consistent with those evaluated during our geotechnical engineering investigation. This inspection should be conducted during drilling and prior to placement of reinforcing steel and concrete.

8.9.8 Loose soils should be removed from the drilled shaft excavation prior to placement of reinforcing steel and concrete.

## 8.10 Exterior Concrete Slabs on Grade

8.10.1 The following recommendations are intended for lightly loaded exterior slabs on grade not subject to vehicular traffic. Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by four (4) inches of class 2 aggregate base over subgrade soils prepared in accordance with the recommendations in section 8.3 of this report. As an alternative, if the School District is willing to accept additional risk for distress to exterior slabs, slabs on grade located outside the building pad may be supported directly over compacted subgrade soils as recommended above.

8.10.2 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that full depth construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

8.10.3 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement.

8.10.4 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

## 8.11 Playcourt Pavement Design

8.11.1 R-Value testing was performed for this investigation on samples obtained from the near surface soils at the site. The results indicated R-values of 60 and 62. Therefore, based on requirements of Caltrans Highway Design Manual, an R-value of 50 was selected for design.

8.11.2 The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. A minimum asphaltic concrete pavement thickness of 2½ inches is recommended for playcourts. In addition, a minimum aggregate base section of 4 inches is recommended where playcourts are designed to accommodate vehicular traffic loads. Assuming a 20-year pavement life, the pavement section consisting of 2½ inches of asphaltic concrete over 4 inches of Caltrans Class 2 aggregate base is equivalent to a traffic index of 5.0. Table 8.11.2 provides playcourt pavement sections for several traffic indices. SALEM should be contacted if pavement section thicknesses for other traffic indices are desired.

**TABLE 8.11.2**
**PLAYCOURT ASPHALT CONCRETE PAVEMENT THICKNESSES**

| Traffic Index | Asphaltic Concrete, (inches) | Class 2 Aggregate Base, (inches)* | Compacted Subgrade, (inches)* |
|---|---|---|---|
| 5.0 | 2.5 | 4.0 | 12.0 |
| 6.0 | 3.0 | 4.0 | 12.0 |
| 7.0 | 4.0 | 4.5 | 12.0 |
| 8.0 | 4.5 | 6.0 | 12.0 |

**** 95% compaction based on ASTM D1557-07 Test Method***

8.11.3 Asphalt concrete should conform to Section 39 of Caltrans' latest Standard Specifications for ½ inch Hot Mix Asphalt (HMA) Type A or B. Asphaltic concrete pavements should be placed in accordance with Caltrans Standard Specifications.

8.11.4 Based on the shallow depth to hardpan soils, there is a potential for perched water conditions to occur. Therefore, to prevent migration of water below pavement areas, where playcourts adjoin open areas or landscape areas, an inverted curb should be constructed to the bottom of the proposed aggregate base section.

8.11.5 Excavations, depressions, or soft and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. Any buried structures encountered during construction should be properly removed and backfilled.

8.11.6 Buried structures encountered during construction should be properly removed/rerouted and the resulting excavations backfilled. It is suspected that demolition activities of the existing pavement will disturb the upper soils. After demolition activities, it is recommended that disturbed soils within pavement areas be removed and/or compacted as engineered fill.

8.11.7 An integral part of satisfactory fill placement is the stability of the placed lift of soil. Prior to placement of aggregate base, the subgrade soils should be proof-rolled by a loaded water truck (or equivalent) to verify no deflections of greater than ½ inch occur. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

8.11.8 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material.

## 9. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

### 9.1 Plan and Specification Review

9.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

### 9.2 Construction Observation and Testing Services

9.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

9.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

## 10. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between borings. The nature and extent of such variations may not become evident until construction is initiated.

If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 271-9700.

Respectfully Submitted,

**SALEM ENGINEERING GROUP, INC.**

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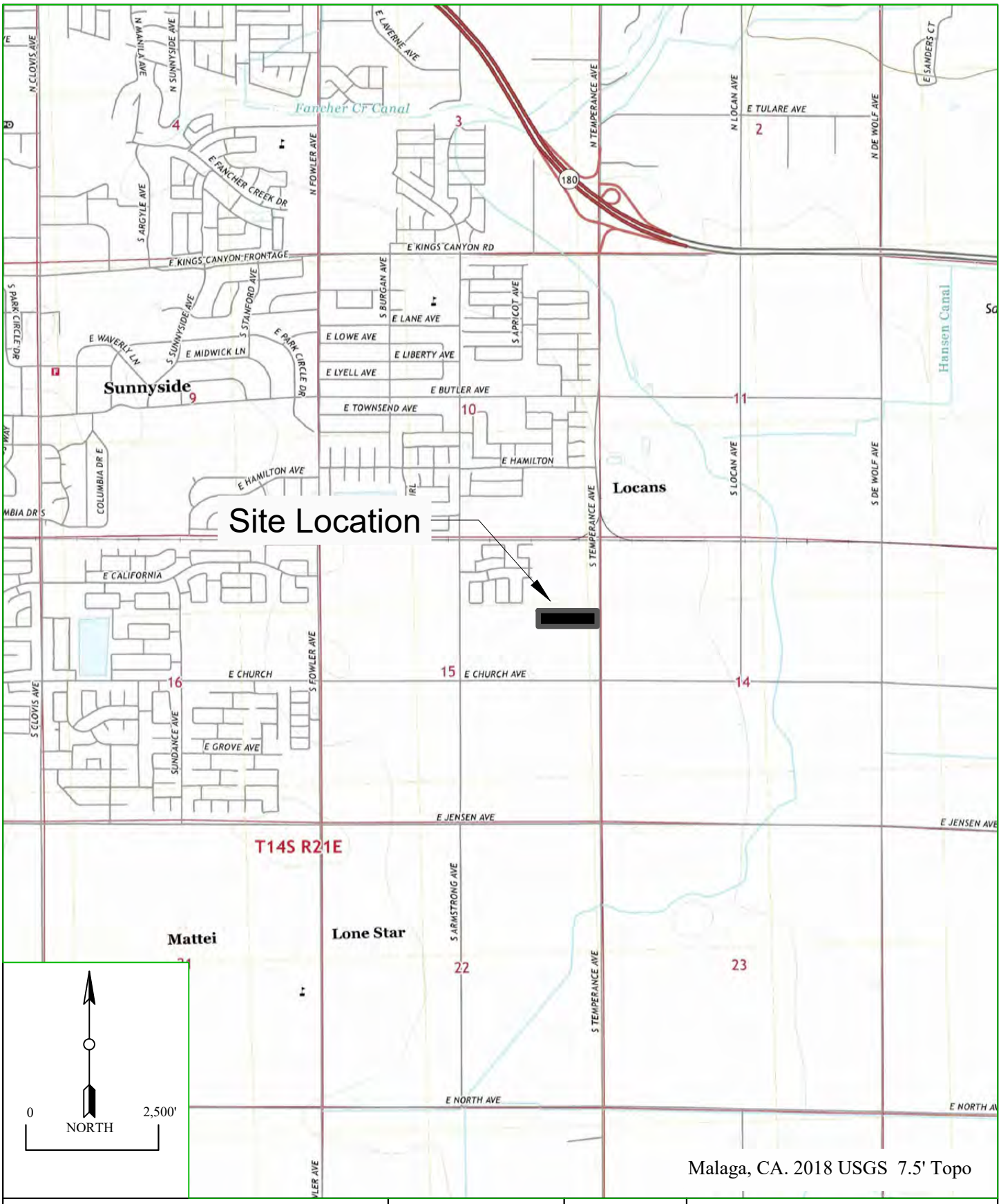
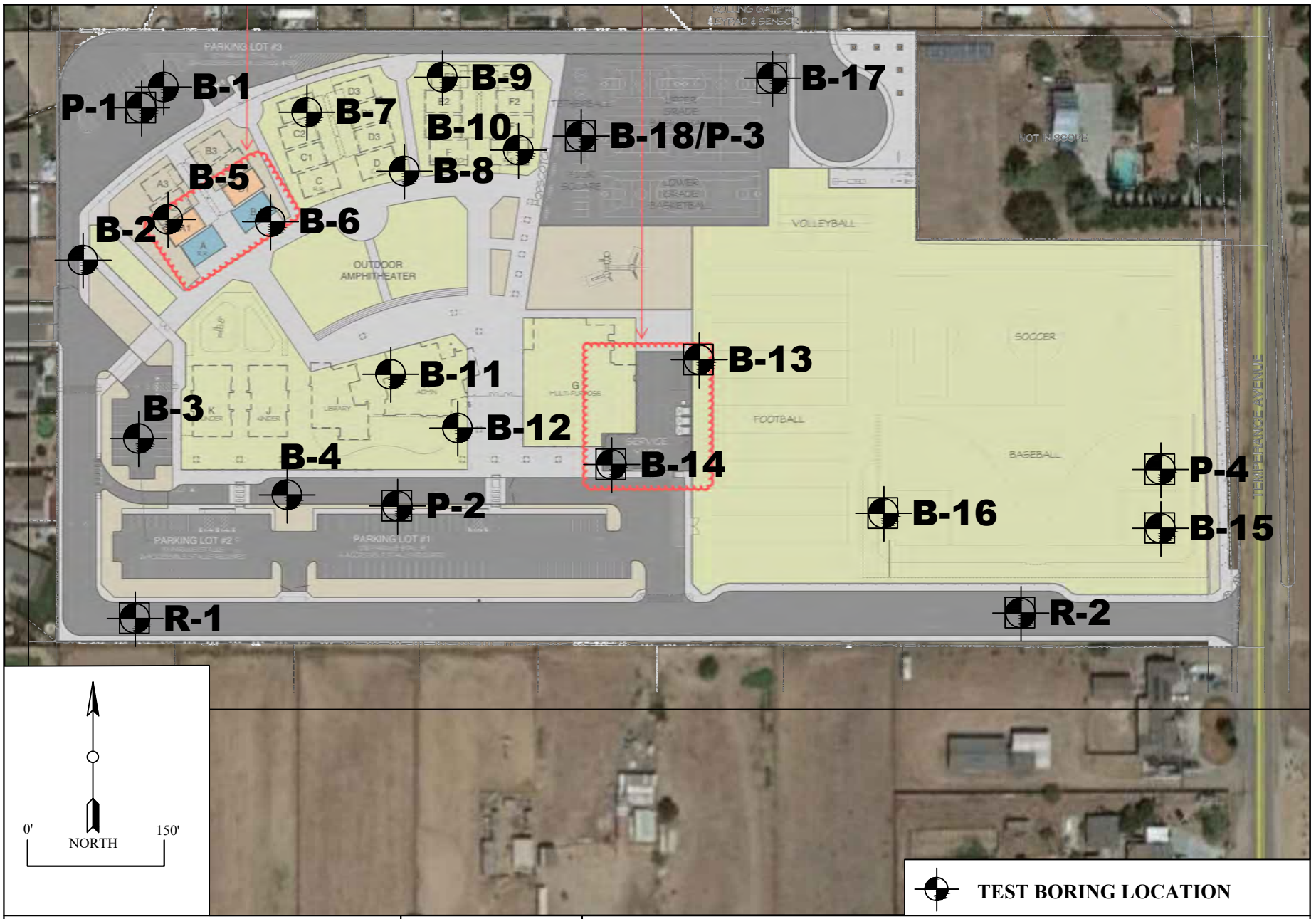



Malaga, CA. 2018 USGS 7.5' Topo

| | | | |
|---|---|---|---|
| VICINITY MAP | SCALE: 1 : 2500' | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR THE SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 1 | |




| | | | |
|---|---|---|---|
| SITE PLAN | SCALE: 1"=150' | DATE: Sept 2020 | SALEM engineering group, inc. |
| PROPOSED TEMPERANCE ELEMENTARY SCHOOL<br>NEAR SW CORNER OF E. CALIFORNIA & S. TEMPERANCE AVENUE<br>FRESNO, CALIFORNIA | DRAWN BY: VT | APPROVED BY: DL | |
| | PROJECT NO. 1-220-0695 | FIGURE NO. 2 | |

# APPENDIX 5

## Noise & Groundborne Vibration Impact Assessment

**(Note: Appendices to Appendix 5 are available upon request by contacting Daniel Brannick at daniel@odellplanning.com or (559) 472-7167)**

# NOISE & GROUNDBORNE VIBRATION IMPACT ASSESSMENT

FOR THE PROPOSED

## NEW SOUTHEAST FRESNO ELEMENTARY SCHOOL PROJECT

COUNTY OF FRESNO, CA

**OCTOBER 2022**


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

**PREPARED BY:**
AMBIENT
AIR QUALITY & NOISE CONSULTING
75 HIGUERA ST, SUITE 105
SAN LUIS OBISPO, CA 93401

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LIST OF COMMON TERMS & ACRONYMS

| | |
|---|---|
| ANSI | Acoustical National Standards Institute |
| Caltrans | California Department of Transportation |
| CEQA | California Environmental Quality Act |
| CNEL | Community Noise Equivalent Level |
| dB | Decibels |
| dBA | A-Weighted Decibels |
| FAA | Federal Aviation Administration |
| FHWA | Federal Highway Administration |
| Hz | Hertz |
| in/sec | Inches per Second |
| $L_{dn}$ | Day-Night Average Sound Level |
| $L_{eq}$ | Equivalent Sound Level |
| $L_{50}$ | Sound Level Exceeded 50 Percent of the Time |
| $L_{max}$ | Maximum Sound Level |
| ppv | Peak Particle Velocity |
| SEL | Sound-Exposure Level |
| U.S. EPA | United States Environmental Protection Agency |

# INTRODUCTION

This report discusses the existing setting, identifies potential noise and groundborne vibration impacts associated with the implementation of the proposed New Southeast Fresno Elementary School Project. Mitigation measures are recommended where the predicted noise and groundborne vibration levels would exceed applicable thresholds of significance.

# PROPOSED PROJECT

The Sanger Unified School District (District) is proposing to undertake the New Southeast Fresno Elementary School Project (project).

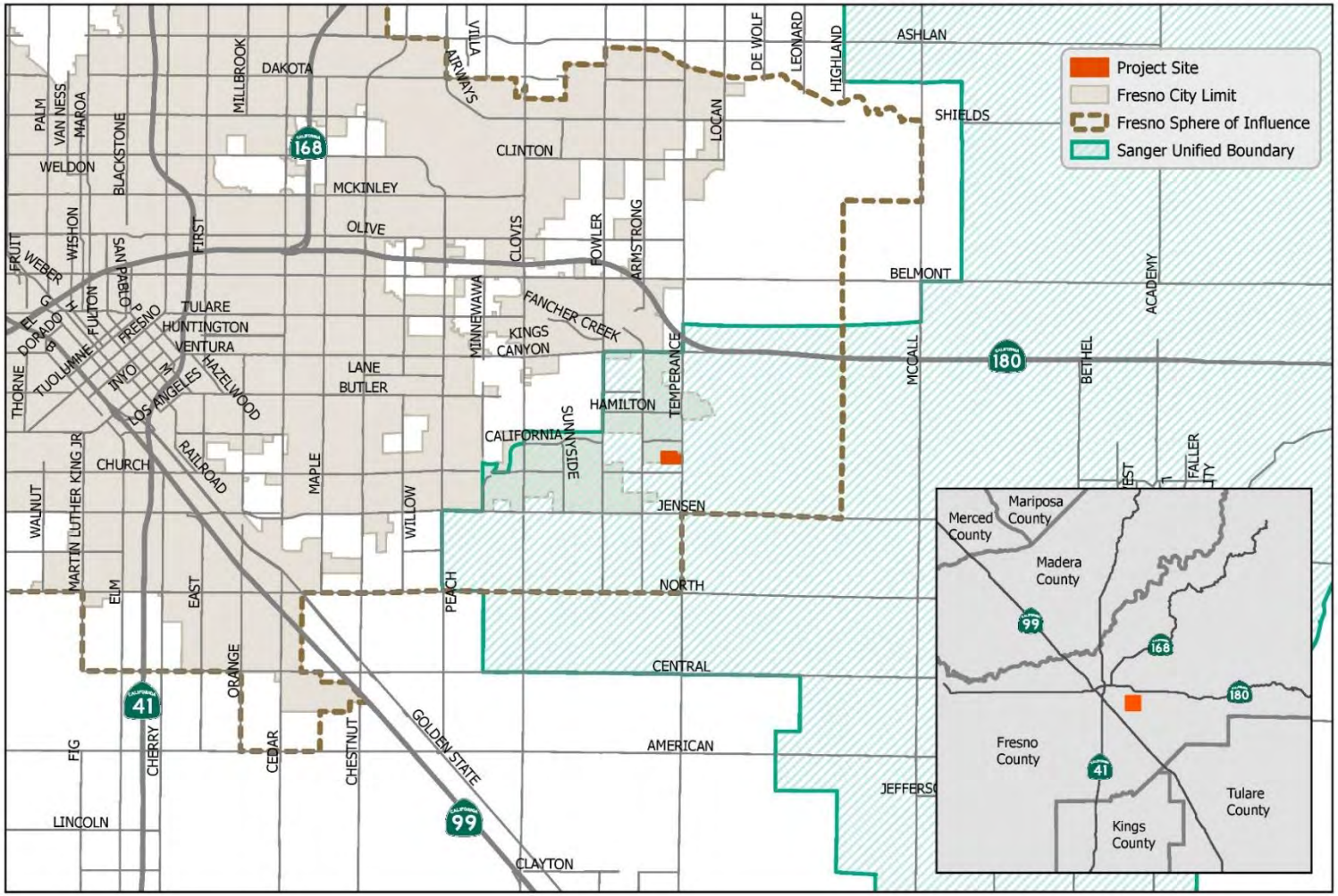
The project site encompasses 17.93 acres located on the west side of Temperance Avenue approximately 700 feet north of Church Avenue in an unincorporated portion of Fresno County, California (APNs 316-160-46 and 316-160-72). The site is immediately adjacent to the City of Fresno's city limits and is within the Fresno Sphere of Influence. The location of the project site is displayed in Figures 1 and 2.

The District is proposing to develop the New Southeast Fresno Elementary School Project to serve the anticipated student enrollment growth generated by new urban development within southeast Fresno. The proposed elementary school will be designed to provide capacity for approximately 700 students in kindergarten through sixth grades. This campus will have approximately 45 employees (including administrators, faculty, and support staff). Facilities planned as part of the project include administrative offices, classrooms, a multi-purpose building, sport fields, physical education facilities, and parking areas (refer to Figure 3). Instructional activities at the elementary school will be in regular session on weekdays from late August to early June, with additional special events and classes during evenings, on weekends, and during the summer recess.

The project includes the annexation of the site to the City of Fresno. It is anticipated that the project will be served by the City of Fresno's water and sewer systems.

Construction of the project will likely begin within the next five years to coincide with planned residential development in the area and funding availability.

## Figure 1. Project Location




**Project Location** **Figure 1**

New Southeast Fresno Elementary School Project
Sanger Unified School District

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

0 0.5 1 2 Miles

N

**Figure 2. Project Site**

**Figure 3. Project Site Plan**

# ACOUSTIC FUNDAMENTALS

Noise is generally defined as a sound that is loud, disagreeable, or unexpected. Sound is mechanical energy transmitted in the form of a wave because of a disturbance or vibration. Sound levels are described in terms of both amplitude and frequency.

## Amplitude

Amplitude is defined as 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 sound source of 65 dB, 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

The frequency of a sound is defined as the number of fluctuations of 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. For instance, the human ear is more sensitive to sound in the higher portion of this range than in the lower, and sound waves below 16 Hz or above 20,000 Hz cannot be heard at all. To approximate the sensitivity of the human ear to changes in frequency, the environmental sound is usually measured in what is referred to as "A-weighted decibels" (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA (U.S. EPA 1971). Common community noise sources and associated noise levels, in dBA, are depicted in Figure 4.

## Addition of Decibels

Because dBs are logarithmic units, sound levels cannot be added or subtracted through ordinary arithmetic. Under the dB 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 dB scale, three sources of equal loudness together would produce an increase of 5 dB.

## Sound Propagation & Attenuation

### Geometric 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 dBs 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 dBs 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 the 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 dBs per doubling of distance from the source.

## Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

## 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 a minimum of 5 dB noise reduction. Taller barriers provide increased noise reduction.

Noise reductions afforded by building construction can vary depending on construction materials and techniques. Standard construction practices typically provide approximately 15 dBA exterior-to-interior noise reductions for building facades, with windows open, and approximately 20-30 dBA with windows closed. The absorptive characteristics of interior rooms, such as carpeted floors, draperies, and furniture, can result in further reductions in interior noise.

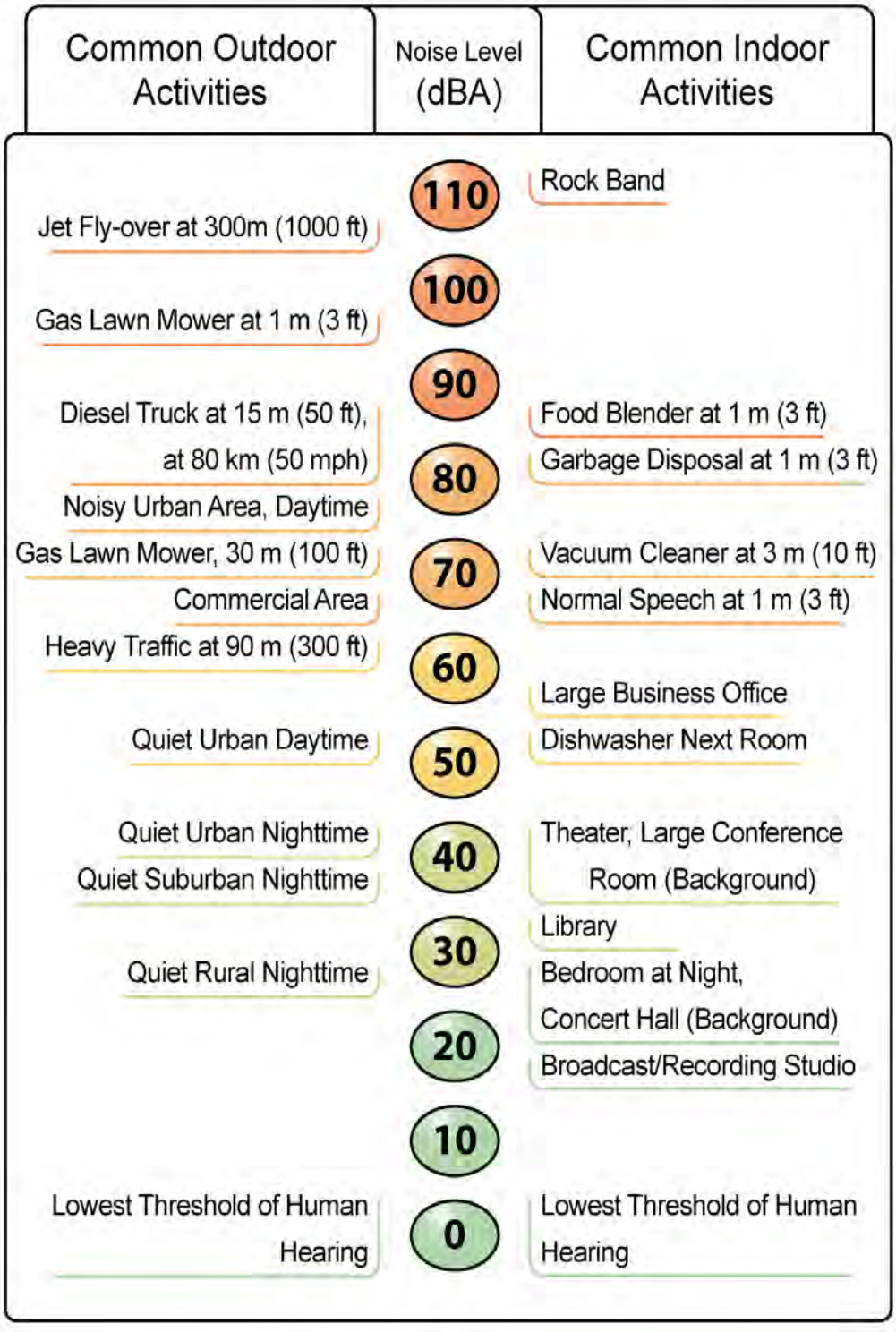
# Noise Descriptors

The dB 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 with 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-scale sound levels of those sounds. 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 equivalent sound level ($L_{eq}$), day-night average sound level ($L_{dn}$), community noise equivalent level (CNEL), and sound-exposure level (SEL). The energy-equivalent sound 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 sound 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 a 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Another descriptor that is commonly discussed is the sound-exposure level, expressed as SEL. The SEL describes a receiver's cumulative noise exposure from a single noise event, which is defined as an acoustical event of a short duration (0.5 seconds), such as a backup beeper, the sound of an airplane traveling overhead, or a train whistle. The percentile noise level ($L_n$) descriptor represents the percent exceeded over a period of time. For instance, $L_{50}$ represents a noise level exceeding 50 percent of the time. Common noise level descriptors are summarized in Table 1.

**Figure 4. Common Noise Levels**




Source: Caltrans 2018

**Table 1. Common Acoustical Descriptors**

| Descriptor | Definition |
|---|---|
| Energy Equivalent Noise Level ($L_{eq}$) | The mean (average) energy 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. |
| Percentile Noise Level ($L_n$) | The percent exceeded over a period of time. For instance, $L_{50}$ represents a noise level exceeding 50 percent of the time. |
| Day-Night Average Noise Level (DNL or $L_{dn}$) | The DNL was first recommended by the United States Environmental Protection Agency (U.S. EPA) in 1974 as a "simple, uniform and appropriate way" of measuring long-term environmental noise. DNL takes into account both the frequency of occurrence and duration of all noise events during a 24-hour period with a 10 dBA "penalty" for noise events that occur between the more noise-sensitive hours of 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 $L_{dn}$. |
| Sound Exposure Level (SEL) | The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second. |

## 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 is 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 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 change of 3 dB is considered a just-perceivable difference;
- A change in sound 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 change of 10 dB 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, a 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 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, exterior noise levels of 60 dBA $L_{eq}$ allow 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.

### 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 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 percentage 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.

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 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.

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.)

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 pass byes, 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 maximum sound level ($L_{max}$) 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.

# AFFECTED ENVIRONMENT

## Noise-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places 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. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

Nearby existing land uses consist predominantly of residential and agriculture. The nearest sensitive land uses located in the vicinity of the proposed project site include residential dwellings, which are located adjacent to the northern, southern, and western property boundaries. Agricultural land use is located across Temperance Ave, approximately 40 feet east of the eastern property boundary.

## Ambient Noise Environment

To document existing ambient noise levels in the project area, short-term ambient noise measurements were conducted on February 14, 2020, using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter. The meter was calibrated before use and is certified to comply with Acoustical National Standards Institute (ANSI) specifications. Measured ambient daytime noise levels are summarized in Table 2 and detailed in Appendix A, Noise Measurement Survey.

**Table 2. Summary of Measured Ambient Noise Levels**

| Location | Monitoring Period (24-hour time) | Measured Daytime Noise Levels (dBA $L_{eq}$) |
|---|---|---|
| ST1: Edge of the roadway of Temperance Avenue. | 11:55-12:05 | 64.3 |
| ST2: Edge of the roadway of Temperance Avenue. | 12:12-12:22 | 61.5 |
| dBA = A-weighted decibel; Leq = Equivalent sound level; ST = Short-term noise measurement<br>Ambient noise measurements were conducted on February 14, 2020, using a Larson Davis Laboratories, Type I, Model 820 integrating sound level meter placed at a height of 5 feet. | | |

Based on the measurements conducted, daytime average-hourly noise levels in the project vicinity ranged from the low to mid-60s (in dBA $L_{eq}$). Nighttime noise levels are typically approximately 5 to 10 dB lower than daytime noise levels. Ambient noise levels within the project area are predominantly influenced by vehicle traffic on area roadways.

# REGULATORY FRAMEWORK

## Noise

### State of California General Plan Guidelines

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

The *State of California General Plan Guidelines,* published by the Governor's Office of Planning and Research (OPR 2003), 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/$L_{dn}$.

## City of Fresno General Plan

The *Fresno General Plan Noise and Safety Element* include noise standards for both transportation and non-transportation noise sources for the determination of land use compatibility. In accordance with the General Plan policies, new noise-sensitive land uses impacted by existing or projected future transportation or stationary noise sources shall include mitigation measures so that resulting noise levels do not exceed these standards (City of Fresno 2014). The land use compatibility noise standards for transportation and non-transportation (stationary) noise sources are summarized in Tables 3 and 4, respectively. In addition, Policy NS-1-a of the *Fresno General Plan Noise and Safety Element* also establishes an exterior noise standard of 60 dBA CNEL/$L_{dn}$ for new non-transportation noise sources that impinge on noise-sensitive land uses, such as residential dwellings. This noise standard is applied at the property line of the noise-sensitive land use.

## City of Fresno Noise-Control Ordinance

The City of Fresno has also adopted a noise ordinance that contains additional limitations intended to prevent noise that may create dangerous, injurious, noxious, or otherwise objectionable conditions. As opposed to the City's General Plan noise standards, the City's noise ordinance is primarily used for the regulation of existing uses and activities, including construction activities, and is not typically used as a basis for land use planning. Construction activities occurring during the daytime hours of 7:00 a.m. to 10:00 p.m., Monday through Saturday, are typically considered exempt from the City's noise ordinance requirements. In accordance with Section 15-2506(H) of the City's noise ordinance, the sounding of school bells and school-sanctioned outdoor activities such as pep rallies, sports games, and band practices are exempt from the City's noise ordinance standards.

**Table 3. Transportation (Non-Aircraft) Noise Sources**

| Noise-Sensitive Land Use[1] | Outdoor Activity Areas[2] | Interior Spaces | |
|---|---|---|---|
| | $L_{dn}$/CNEL, dB | $L_{dn}$/CNEL, dB | $L_{eq}$, dB[2] |
| Residential | 65 | 45 | - |
| Transient Lodging | 65 | 45 | - |
| Hospitals, Nursing Homes | 65 | 45 | - |
| Theaters, Auditoriums, Music Halls | - | - | 35 |
| Churches, Meeting Halls | 65 | - | 45 |
| Office Buildings | - | - | 45 |
| Schools, Libraries, Museums | - | - | 45 |

1. Where the location of outdoor activity areas is unknown or is not applicable, the exterior noise level standard shall be applied to the property line of the receiving land use.
2. As determined for a typical worst-case hour during periods of use.

**Table 4. Stationary Noise Sources[1]**

| | Daytime (7:00 a.m. – 10:00 p.m.) | Nighttime (10:00 p.m. – 7:00 a.m.) |
|---|---|---|
| Hourly Equivalent Sound Level ($L_{eq}$), dBA | 50 | 45 |
| Maximum Sound Level ($L_{max}$), dBA | 70 | 60 |

1. The Department of Development and Resource Management Director, on a case-by-case basis, may designate land uses other than those shown in this table to be noise-sensitive and may require appropriate noise mitigation measures.
2. As determined at outdoor activity areas. Where the location of outdoor activity areas is unknown or not applicable, the noise exposure standard shall be applied at the property line of the receiving land use. When ambient noise levels exceed or equal the levels in this table, mitigation shall only be required to limit noise to the ambient plus five dB.

## Fresno County Noise-Control Ordinance

The intent of the Fresno County Noise Control Ordinance is "...to protect persons from excessive levels of noise within or near a residence, school, church, hospital or public library and to warn persons of the hazards of excessive noise in places of public entertainment." The County's exterior and interior noise standards are summarized in Table 5 and Table 6, respectively.

As noted in Tables 5 and 6, the County's noise standards vary depending on the type of noise being generated and the cumulative duration of exposure. These standards are typically referred to as the percent exceeded level ($L_n$). The $L_n$ is the sound pressure level exceeded for a given percent of the time. For instance, the "$L_{50}$" represents the sound level not to be exceeded 50 percent of the time, or 30 minutes within a one-hour time period. Likewise, a fifteen-minute limitation is expressed as the $L_{25}$, a five-minute limitation is expressed as the $L_8$, and a one-minute limitation is expressed as the $L_2$. The $L_0$ represents the noise level not to be exceeded at any time, which is also often referred to as the $L_{max}$. For most sources, the $L_{50}$ is also representative of the energy-equivalent sound level, represented as "$L_{eq}$". The County's noise control ordinance identifies both exterior and interior standards that apply to non-transportation noise sources located within the County. The standards are applied at noise-sensitive land uses (e.g., single- or multiple-family residence, school, hospital, church or public library). It is important to note, however, that in accordance with Chapter 8.40, Section 8.40.060 of the County's noise control ordinance, activities conducted in public parks, public playgrounds, and public or private school grounds, including but not limited to school athletic and school entertainment events are exempt from these standards. Various other noise-generating activities, including agricultural and waste collection activities for non-residential properties and are also exempt from these standards. Construction activities occurring during between 6:00 a.m. and 9:00 p.m. on weekdays and between 7:00 a.m. and 9:00 p.m. on weekends are also exempt.

**Table 5**
**Fresno County Exterior Noise Exposure Standards for Non-Transportation Sources**

| Cumulative Number of Minutes in any One-Hour Time Period | Noise Level Standards, dBA | |
|---|---|---|
| | Daytime (7 a.m. to 10 p.m.) | Nighttime (10 a.m. to 7 p.m.) |
| 30 ($L_{50}$) | 50 | 45 |
| 15 ($L_{25}$) | 55 | 50 |
| 5 ($L_8$) | 60 | 55 |
| 1 ($L_2$) | 65 | 60 |
| 0 ($L_0/L_{max}$) | 70 | 65 |

a. It is unlawful for any person, including an owner, whether through the owner or the owner's agent, lessee, sublessor, sublessee or occupant, at any location within the unincorporated area of the county, to create any noise, or to allow the creation of any noise, on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any affected single- or multiple-family residence, school, hospital, church or public library situation in either the incorporated or unincorporated area to exceed the noise level standards as set forth in this table.

b. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal the ambient noise level.

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

d. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

**Table 6**
**Fresno County Interior Noise Exposure Standards for Non-Transportation Sources**

| Cumulative Number of Minutes in any One-Hour Time Period | Noise Level Standards, dBA | |
|---|---|---|
| | Daytime (7 a.m. to 10 p.m.) | Nighttime (10 a.m. to 7 p.m.) |
| 5 ($L_8$) | 45 | 35 |
| 1 ($L_2$) | 50 | 40 |
| 0 ($L_0$/$L_{max}$) | 55 | 45 |

a. It is unlawful for any person, at any location within the unincorporated area of the county to operate or cause to be operated within a dwelling unit, any source of sound or to allow the creation of any noise which causes the noise level when measured inside a receiving dwelling unit situated in either the incorporated or unincorporated are to exceed the noise level standards as set forth in this table.

b. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal the ambient noise level.

c. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulse noises.

d. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

## 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 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, the California Department of Transportation (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 7. 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 2020).

**Table 7. 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 are unlikely to cause damage of any type. |
| 0.08 | Vibrations are readily perceptible. | Recommended upper level of the vibration to which ruins and ancient monuments should be subjected. |
| 0.1 | The level at which continuous vibrations begin to annoy people. | Virtually no risk of "architectural" damage to normal buildings. |
| 0.2 | 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). | The threshold at which there is a risk of "architectural" damage to fragile buildings. |
| 0.3 - 0.6 | Vibrations become distinctly perceptible at 0.04 in/sec ppv and are considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges. | The 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. |

in/sec = Inch per second; ppv = Peak particle velocity

The vibration levels are based on ppv in the vertical direction for continuous vibration sources, which includes most construction activities.

Source: Caltrans 2020

As indicated in Table 7, 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. The City of Fresno does not have an adopted criterion pertaining to construction-generated groundborne vibration.

# Impact Analysis

## Thresholds of Significance

Criteria for determining the significance of air quality impacts were developed based on information contained in the California Environmental Quality Act (CEQA) Guidelines (Appendix G). According to those guidelines, a project may have a significant effect on the environment if it would result in the following conditions:

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies; or

b) Generation of excessive groundborne vibration or groundborne noise levels; or

c) 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 private-use airport, that exposes people residing or working in the project area to excessive noise levels.

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

- 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., 9:00 p.m. to 7:00 a.m.) or if construction-generated noise levels would exceed applicable noise standards during this same period. Construction activities occurring during the daytime hours of 7:00 a.m. to 9:00 p.m. are typically considered exempt from the City of Fresno and County of Fresno noise-control regulations.
- 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 applicable noise exposure standards. For residential land uses, non-transportation noise levels exceeding the City/County daytime noise standard of 50 dBA $L_{eq}/L_{50}$ would be considered to have a potentially significant impact. These noise thresholds are based on noise limitations identified in the City of Fresno General Plan and the County of Fresno noise-control ordinance. For purposes of this analysis, predicted noise levels expressed in dBA $L_{eq}$ are considered equivalent to $L_{50}$ noise levels.
- Groundborne Vibration. The CEQA Guidelines do not define the levels at which ground-borne vibration levels would be considered excessive. For this reason, Caltrans' recommended ground-borne vibration thresholds were used for the evaluation of impacts based on increased potential for structural damage and human annoyance, as identified in Table 7. 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 (Caltrans 2020).
- 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 5 dBA, or greater.

## Methodology

### Construction Impacts

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 use. Noise levels were predicted based on representative off-road equipment noise levels derived from the Federal Highway Administration's (FHWA) Roadway Construction Noise Model based on average equipment usage rates and assuming a noise-attenuation rate of 6 dB per doubling of distance from the source.

### Operational Impacts

*Roadway Traffic Noise*

Traffic noise levels were calculated using the FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108) based on California 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. Predicted noise levels were compared to the City of Fresno transportation noise source standards for the determination of impact significance.

*Non-Transportation Noise*

Noise levels associated with vehicle parking areas were calculated in accordance with FHWA's Transit Noise and Vibration Impact Assessment Guidelines assuming a reference noise level of 92 dBA SEL. Average-hourly noise levels associated with vehicle parking-related activities were calculated based on the conservative assumption that all parking spaces would be accessed over a one-hour period. Noise levels generated by other on-site noise sources were assessed based on the representative manufacturer and measured data obtained from similar sources.

Non-transportation noise sources were evaluated in comparison to the City's stationary noise source standards. Operational noise levels were calculated at the exterior and interior of the nearest noise-sensitive land use. Interior noise levels were calculated based on the predicted exterior noise level and assuming an average exterior-to-interior noise reduction of 15 dB.

## Project Impacts and Mitigation Measures

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

### Construction-Related Noise Levels

Construction noise typically occurs intermittently and varies depending upon the phase (e.g., land clearing, grading, excavation, and erection). Noise generated by construction equipment, including earthmovers, material handlers, and portable generators, can reach high levels. Noise levels commonly associated with off-road equipment anticipated to be used during project construction are summarized in Table 8.

As noted in Table 8, instantaneous noise levels generated by individual pieces of off-road equipment typically range from approximately 77 to 90 dBA $L_{max}$ at 50 feet. 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 for individual equipment would be approximately 83 dBA $L_{eq}$, or less, at 50 feet. Assuming that multiple pieces of equipment could be operating simultaneously, predicted average-hourly noise levels could reach levels of approximately 85 dBA at 50 feet.

**Table 8. Typical Construction Equipment Noise Levels**

| Equipment | Typical Noise Level (dBA) at 50 Feet from Source | |
|---|---|---|
| | $L_{max}$ | $L_{eq}$ |
| Air Compressor | 78 | 74 |
| Backhoe | 78 | 74 |
| Concrete Mixer | 79 | 75 |
| Crane, Mobile | 81 | 73 |
| Dozer | 82 | 78 |
| Grader | 85 | 81 |
| Loader | 79 | 71 |
| Paver | 77 | 74 |
| Roller | 80 | 73 |
| Saw | 90 | 83 |

dBA = A-weighted decibels; $L_{max}$ = Maximum sound level; $L_{eq}$ = Equivalent sound level
Source: FHWA Roadway Construction Noise Model

The nearest noise-sensitive land uses located in the vicinity of the proposed project site include residential dwellings, which are located adjacent to the northern, southern, and western property boundaries. Assuming that construction activities were to occur near the project site boundary, predicted exterior noise levels would be approximately 85 dBA $L_{eq}$ at the outdoor activity areas of the nearest residential dwellings. Based on this exterior noise level and assuming an average exterior-to-interior noise reduction of 15 dB, with windows partially open, predicted interior noise levels at the residential dwellings could reach levels of approximately 70 dBA $L_{eq}$. As previously noted, construction noise levels that occur between 7:00 a.m. and 9:00 p.m. are exempt from the City of Fresno and County of Fresno noise-control regulations. With regards to residential land uses, activities occurring during the more noise-sensitive nighttime hours are of particular concern given the potential for sleep disruption and increased levels of annoyance for building occupants. For these reasons, this impact would be considered potentially significant.

Mitigation Measures

Mitigation Measure N-1: The following measures shall be implemented to reduce construction-generated noise levels:

a) Noise-generating construction activities, including equipment maintenance, shall be limited to the hours between 7:00 a.m. and 9:00 p.m. Noise-generating construction activities shall be prohibited on weekends and national holidays.

b) Stationary construction equipment that generates noise that exceeds 65 dBA at the project boundaries shall be shielded with a barrier that meets a sound transmission class rating of 25.

c) All diesel equipment shall be operated with closed engine doors and shall be equipped with factory-recommended mufflers.

d) Whenever feasible, electrical power shall be used to run air compressors and similar power tools.

e) Construction staging areas shall be located at the furthest distance possible from nearby residential land uses.

Significance After Mitigation

Implementation of the above mitigation measures would limit construction activities to less noise-sensitive periods of the day. The use of mufflers would reduce construction equipment noise levels by approximately 10 dBA. With the implementation of the above mitigation measures and given that construction activities would be short-term and intermittent, this impact would be considered less than significant.

## Operational Noise Levels

Long-term, permanent increases in ambient noise levels would be primarily associated with potential increases in vehicle traffic on nearby roadways; as well as on-site activities. Noise levels commonly associated with these sources and potential impacts to nearby noise-sensitive land uses would be primarily limited to the daytime school operational hours and are discussed as follows:

Vehicular Roadway Traffic

Predicted existing traffic noise levels, with and without the implementation of the proposed project, are summarized in Table 9. In comparison to existing without project traffic noise levels, the proposed project would result in a predicted increase in traffic noise levels of 1.0 dBA along nearby roadways.

**Table 9. Predicted Increase in Existing Traffic Noise Levels**

| Roadway Segment | Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/$L_{dn}$)[1] | | | Substantial Increase?[3] | Exceeds City's Noise Standard?[4] | Significant Impact?[5] |
|---|---|---|---|---|---|---|
| | Existing without Project | Existing with Project | Difference[2] | | | |
| Temperance Avenue, North of Church Avenue | 55.5 | 56.5 | 1.0 | No | No | No |

dBA = A-weighted decibels; CNEL = Community noise equivalent level; $L_{dn}$ = Day-night average sound level
1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Differences in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase is defined as an increase of 5 dB, or greater.
4. Noise-sensitive land uses along evaluated roadway segments would not exceed the City of Fresno noise control ordinance standards.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the City's applicable noise standards at nearby land uses.

Predicted future cumulative traffic noise levels, with and without the implementation of the proposed project, are summarized in Table 10. In comparison to future cumulative without project traffic noise levels, the proposed project would result in a predicted increase in traffic noise levels of 0.2 to 0.3 dBA along nearby roadways.

**Table 10. Predicted Increase in Future Traffic Noise Levels**

| Roadway Segment | Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/$L_{dn}$)[1] | | | Substantial Increase?[3] | Exceeds City's Noise Standard?[4] | Significant Impact?[5] |
|---|---|---|---|---|---|---|
| | Future without Project | Future with Project | Difference[2] | | | |
| Temperance Avenue, North of Church Avenue | 61.1 | 61.3 | 0.2 | No | No | No |
| Temperance Avenue, South of California Avenue | 61.0 | 61.3 | 0.3 | No | No | No |

dBA = A-weighted decibels; CNEL = Community noise equivalent level; $L_{dn}$ = Day-night average sound level
1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Differences in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase is defined as an increase of 5 dB, or greater.
4. Noise-sensitive land uses along evaluated roadway segments would not exceed the City of Fresno noise control ordinance standards.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the City's applicable noise standards at nearby land uses.

As noted earlier in this report, a change in sound level of at least 5 dB is required before any noticeable change in community response would be expected. Implementation of the proposed project would not result in substantial increases (i.e., 5 dBA or greater) in existing and future cumulative conditions along nearby roadways. Predicted traffic noise levels are not projected to exceed the City's exterior and interior noise standards at the nearby residential land use (refer to Appendix B). As a result, this impact would be considered less than significant.

Vehicle Parking Lot

The proposed project may include the construction of a 149-space parking lot generally located within the southwestern portion of the project site (refer to Figure 3). Use of the parking lot would primarily occur during the daytime hours of operation.

The nearest noise-sensitive land use located within the City of Fresno jurisdiction is located adjacent to and west of the project site, approximately 75 feet, or more, from onsite vehicle parking areas. The nearest noise-

sensitive land use located within the County of Fresno is located south of the project site, approximately 82 feet, or more, from onsite vehicle parking areas. Based on a conservative assumption that all parking spaces would be accessed over a one-hour period, predicted exterior noise levels at these nearest residential land uses would be approximately 46 dBA $L_{eq}/L_{50}$, or less. Predicted noise levels associated with on-site parking lot activities would not exceed the exterior daytime noise standard of 50 dBA $L_{eq}/L_{50}$. As a result, this impact would be considered less than significant.

Building Maintenance & Mechanical Equipment

Proposed structures would be anticipated to include the use of building mechanical equipment, such as air conditioning units and exhaust fans. Building mechanical equipment is proposed to be located on the rooftop of permanent buildings and wall-mounted on modular buildings. Use of building mechanical equipment would primarily occur during the daytime hours of operation.

Exterior air conditioning units and exhaust fans can generate noise levels up to approximately 65 dBA $L_{eq}$ at 10 feet. The nearest noise-sensitive land use located within the City of Fresno jurisdiction is located adjacent to and north of the project site, approximately 40 feet from proposed onsite buildings. Assuming an operational noise level 65 dBA $L_{eq}$ and that exterior air conditioning units were located within line-of-sight of the nearest residential land use, predicted noise levels at the property line of this nearest residence would be approximately 53 dBA $L_{eq}/L_{50}$. Predicted noise levels at this nearest residence would exceed the daytime exterior noise standard of 50 dBA $L_{eq}/L_{50}$.

The nearest noise-sensitive land use located within the County of Fresno is located south of the project site, approximately 230 feet from the nearest proposed onsite building. Based on the same assumptions noted above, predicted exterior noise levels at the property line of this nearest residence would be approximately 44 dBA $L_{eq}/L_{50}$. Predicted noise levels at this nearest residence would not exceed the daytime exterior noise standard of 50 dBA $L_{eq}/L_{50}$.

Predicted operational noise levels at the property line of residential land uses located within 100 feet of proposed onsite buildings could potentially exceed the daytime exterior noise standard of 50 dBA $L_{eq}/L_{50}$. As a result, this impact would be considered potentially significant.

Recreational Facilities

The proposed project includes the construction of outdoor recreational-use facilities, including playgrounds, ball courts, and ball fields. Noise generated by outdoor recreational uses typically includes elevated children's voices, occasional adult voices and the sounding of whistles. Use of outdoor recreational facilities would primarily occur during the daytime hours of operation.

Based on measurement data obtained from similar land uses, noise levels associated with onsite recreational facilities would generate noise levels of approximately 50-60 dBA $L_{eq}$ at 50 feet from source center. The nearest noise-sensitive land uses located within the City of Fresno jurisdiction are located adjacent to and north of the project site, approximately 35 feet north of the nearest onsite basketball courts. A residential land use is also located approximately 180 feet east of the proposed volleyball courts. The nearest noise-sensitive land uses located within the County of Fresno are located south of the project site, approximately 125 feet from onsite ball fields. Based on these distances and assuming a source noise level of 60 dBA $L_{eq}$ at 50 feet from source center, predicted exterior noise levels at the property line of the nearest residential land uses to the north of the proposed basketball courts, would be approximately 54 dBA $L_{eq}/L_{50}$. Predicted noise levels at the outdoor facilities of the residential land use to the east of the proposed volleyball courts would be 49 dBA $L_{eq}/L_{50}$. Predicted noise levels at the property line of the nearest residential land uses to the south of the project site would be approximately 48 dBA $L_{eq}/L_{50}$. Predicted noise levels at the property line of the nearest residential land uses to the south of the project site would be approximately 48 dBA $L_{eq}/L_{50}$.

Predicted noise levels associated with the proposed onsite recreational facilities would exceed the daytime exterior noise standard of 50 dBA $L_{eq}/L_{50}$ at the property lines of the nearest residential land uses located to the north of the proposed ball courts. Predicted noise levels with other onsite recreational land uses, including proposed ball fields, would not exceed the daytime exterior noise standard of 50 dBA $L_{eq}/L_{50}$ at the nearest

residential land uses. Noise generated by recreational facilities would be considered to have a potentially significant impact.

Mitigation Measures

Mitigation Measure N-2:

a. Exterior air conditioning units for buildings to be located within 100 feet of residential property lines shall be located on roof-top areas and/or shielded from direct line-of-sight of adjacent residences.

b. Noise barriers shall be constructed along the southern property line of the nearest residential land uses located to the north of the proposed ball courts. The sound barrier shall be constructed to a minimum height of 5 feet above ground level with no visible air gaps between construction components or at the base of the structure. The barrier shall be constructed of wood, metal, or concrete block having a minimum total density of 4 pounds/square foot. Proposed noise barrier locations are depicted in Figure 5.

**Figure 5. Proposed Noise Barrier Locations**


Proposed Noise Barrier Locations

Not to scale

Significance After Mitigation

Placing air conditioning units on rooftop areas or shielded from direct line-of-sight of nearby residences would reduce operational noise levels by approximately 5 dBA, or more. The construction of noise barriers would reduce noise associated with nearby recreational facilities by approximately 5 dBA. It is also important to note that school-related activities, including the use of outdoor recreational facilities, are typically considered exempt from the City's noise ordinance requirements. With the implementation of the above mitigation measures, this impact would be considered less than significant.

Land Use Compatibility

The City of Fresno General Plan Noise Element includes noise standards for the determination of land use compatibility for new land uses. As previously discussed, the City's "normally acceptable" exterior noise standards for schools is 65 dBA CNEL/$L_{dn}$.

As noted earlier in this report, ambient noise levels in the project area are largely influenced by traffic noise on area roadways. Under future cumulative conditions, with project-generated vehicle traffic included, the predicted 65 dBA CNEL/$L_{dn}$ noise contour for Temperance Avenue would be within the roadway right of way. Based on preliminary site plans, the nearest proposed building would be located approximately 680 feet from the centerline of Temperance Avenue. Based on this setback distance, predicted exterior traffic noise levels at the nearest building façade would be 44 dBA CNEL/$L_{dn}$. With compliance with current building insulation standards, average exterior-to-interior noise reductions for newly constructed buildings typically range from approximately 25-30 dB. Assuming an exterior noise level of 44 dBA CNEL/$L_{dn}$ and a minimum exterior-to-interior noise reduction of 25 dB, predicted interior noise levels within the proposed building would be approximately 19 dBA CNEL/$L_{dn}$, or less. Predicted exterior noise levels at outdoor activity areas would be approximately 60 dBA CNEL/$L_{dn}$, or less. Predicted exterior and interior noise levels would not exceed the City's applicable land use compatibility noise standards. As a result, this impact would be considered less than significant.

Impact N-B. Would the project result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Increases in groundborne vibration levels attributable to the proposed project would be primarily associated with short-term construction activities. Groundborne vibration levels associated with representative construction equipment likely to be required during project construction are summarized in Table 11. As depicted, construction-generated vibration levels would range from approximately 0.003 to 0.210 in/sec ppv at 25 feet. The highest vibration levels would be associated with the use of vibratory rollers.

**Table 11. Representative Vibration Levels for Construction Equipment**

| Equipment | Vibration Level at 25 Feet (in/sec, ppv) |
|---|---|
| Vibratory Roller | 0.210 |
| Large Bulldozer | 0.089 |
| Loaded Trucks | 0.076 |
| Small Bulldozers/Tractors | 0.003 |

in/sec = Inch per second; ppv = Peak particle velocity
Source: FTA 2018

The nearest existing structures include residential dwellings, which are located approximately 30 feet from the northern and western property boundaries. Predicted groundborne vibration levels at these nearby structures would be approximately 0.17 in/sec ppv. Predicted vibration levels would not exceed the minimum recommended criteria for structural damage or human annoyance (0.5 in/sec ppv and 0.2 in/sec ppv, respectively). As a result, this impact would be considered less than significant.

Impact N-C. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? and for a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

The nearest airport is the Fresno Yosemite International Airport, which is located approximately 3.7 miles northwest of the project site. The proposed project is not located within the predicted noise contour zones of the airport. As a result, the proposed project would not subject on-site employees or students to potentially hazardous noise conditions associated with aircraft operations nor would the implementation of the proposed project affect airport operations. As a result, this impact would be considered less than significant.

# REFERENCES


California Department of Transportation (Caltrans). 2018. *EIR/EA Annotated Outline*.

California Department of Transportation (Caltrans). 2020. *Transportation and Construction-Induced Vibration Guidance Manual.*

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U.S. Department of Transportation, Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment.*

U.S. Environmental Protection Agency (U.S. EPA). 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*.

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# APPENDIX 6

## Traffic Impact Analysis

**(Note: Appendices to Appendix 6 are available upon request by contacting Daniel Brannick at daniel@odellplanning.com or (559) 472-7167)**

# Draft Traffic Impact Analysis Report

## Sanger Unified School District
## Elementary School

**Located on the Northwest Quadrant of**
**Temperance Avenue and Church Avenue**

**In Fresno County, California**

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

June 24, 2021

Project No. 009 025


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*Traffic Engineering, Transportation Planning, & Parking Solutions*

# Draft Traffic Impact Analysis Report

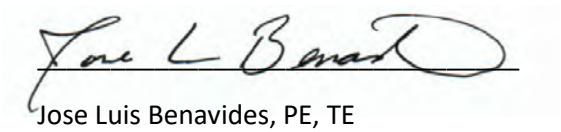
## For the Sanger Unified School District Elementary School located on the Northwest Quadrant of Temperance Avenue and Church Avenue

In Fresno County, California

June 24, 2021

This Draft 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:

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# Introduction and Summary

## Introduction

This Draft Report describes a Traffic Impact Analysis (TIA) and Vehicle Miles Traveled (VMT) Analysis prepared by JLB Traffic Engineering, Inc. (JLB) for the Sanger Unified School District (SUSD) Elementary School (Project) to be located in Fresno County adjacent to the City of Fresno. Specifically, the Project site is located on 17.9 acres on the northwest quadrant of Temperance Avenue and Church Avenue. Based on data provided by SUSD, the Project is located within a defined service area that is currently being served by other schools.

The Project site is located within the City of Fresno Sphere of Influence and is adjacent to the Fresno City limits on two sides. Moreover, the Project site is located in an area that is experiencing urbanization and is planned for future residential development as part of the *Fresno General Plan* and County-adopted Roosevelt Community Plan. SUSD indicates the new school site is vital to serve the student population growth anticipated to be generated by the planned surrounding development. Figure 1 shows the location of the proposed Project site relative to the surrounding roadway network.

The Project proposes to a) construct administrative offices, classrooms, a multi-purpose building, and physical education facilities/outdoor play areas, b) include approximately 45 employees, including administrators, faculty, and support staff, and c) serve approximately 700 students in transitional kindergarten through sixth grades. The timing for the construction of the Project is estimated to be in approximately three to five years to coincide with the planned surrounding development.

The purpose of the TIA is to evaluate the potential on-site and off-site traffic impacts, identify short-term and long-term roadway and circulation needs, determine potential roadway improvement measures, and identify any critical traffic issues that should be addressed in the on-going planning process. The TIA primarily focused on evaluating traffic conditions at study intersections that may potentially be impacted by the proposed Project and a Vehicle Miles Traveled Analysis. The Scope of Work was prepared via consultation with Fresno County, City of Fresno 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) policies of the City of Fresno, Fresno County and Caltrans, and the City of Fresno policy on VMT.

### *Existing Traffic Conditions*

- Based on a review of the collision reports during the most recent five-year period, a total of 30 collisions were reported within the influence zone of the study intersections. The intersection of Armstrong Avenue and Church Avenue has experienced an average of two broadside collisions per year, while the intersection of Temperance Avenue and Church Avenue has experienced approximately two broadside collisions per year since 2018. However, between July 1, 2019 and June 30, 2020 the intersection of Temperance Avenue and Church Avenue experienced a total of five collisions that can be correctable by the implementation of all-way stop traffic controls or improving corner sight distance.
- At present, all study intersections operate at an acceptable LOS during both peak periods.

### *Existing plus Project Traffic Conditions*

- The latest Project Site Plan integrates recommendations to a) add a secondary access point to the parking lot located along the north side of Truman Avenue and b) modify the parent drop-off exit to add a dedicated left-turn lane and right-turn lane and redesign the exit to encourage traffic toward Temperance Avenue as opposed to the neighborhood streets adjacent to the Project site.
- 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.
- At build-out, the Project is estimated to generate a maximum of 1,323 daily trips, 469 AM peak hour trips and 119 PM peak hour trips.
- It is recommended that the Project implement Class I and Class II Bikeways along its frontage to Temperance Avenue consistent with the *Fresno ATP*.
- It is recommended that the Project implement pedestrian sidewalks and Class I Bike Paths consistent with the Fresno *ATP* within and adjacent to the Project site. Adjacent to the Project site, it is recommended that the Project implement pedestrian sidewalks along future portions of Truman Avenue. Moreover, it is recommended that the Project implement a Class I Bike Path along its frontage to Temperance Avenue.
- At present, there are no FAX transit routes that operate adjacent to or in the vicinity of the Project.
- FCRTA provides transit services for those communities not served by FAX, Stageline or Round Up. Orange Cove Inter-City Transit provides scheduled round trip inter-city service through Orange Cove, Reedley, Parlier, Sanger, and the Fresno-Clovis Metropolitan Area Monday through Friday.

- At present, the average VMT to existing schools is 3.4 miles (round-trip). Upon completion of the Project, the average VMT is projected to be 2.4 miles (round-trip). Considering the Project is located in an area surrounded by residential land uses with adequate walking and bicycle facilities, it is anticipated that a majority of children will walk and bike to the Project site further reducing the Project's transportation VMT impact. Therefore, the Project is presumed to create a less than significant impact.
- In order to promote alternative modes of transportation to and from the Project site and improve student safety, it is recommended that SUSD work with the City of Fresno 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 Fresno, 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 Fresno County, City of Fresno and Caltrans staff were consulted throughout the preparation of this Report regarding Near Term Projects that could potentially impact the study intersections. JLB staff conducted a reconnaissance of the surrounding area and confirmed the Near Term Projects were approved, near approval, or in the pipeline within the proximity of the proposed Project.
- The total trip generation for the Near Term Projects is 102,312 daily trips, 8,307 AM peak hour trips and 9,817 PM peak hour trips.
- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, the addition of lanes and modification of traffic control mechanisms is recommended. Additional details as to the recommended improvements for these intersections are presented later in this Report.

### *Cumulative Year 2040 No Project Traffic Conditions*

- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Temperance Avenue and Truman Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, the addition of lanes and modification of traffic control mechanisms is recommended. Additional details as to the recommended improvements for these intersections are presented later in this Report.

### *Cumulative Year 2040 plus Project Traffic Conditions*

- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Temperance Avenue and Truman Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue are projected to exceed their LOS threshold during one or both peak periods. To improve the LOS at these intersections, the addition of lanes and modification of traffic control mechanisms is recommended. Additional details as to the recommended improvements for these intersections are presented later in this Report.

### *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 X 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 March 23, 2021, a Draft Scope of Work for the preparation of a TIA and VMT analysis for this Project was provided to Fresno County, City of Fresno and Caltrans staff for their review and comment. The Draft Scope of Work was based on communication with City of Fresno staff and the Traffic Impact Analysis Guidelines of lead and responsible agencies. Any comments to the proposed Scope of Work were to be provided by April 6, 2021.

On April 1, 2021, Caltrans responded and approved the Draft Scope of Work as presented. However, Caltrans recommended that the lead agency request a review of traffic safety and indicate whether a VMT analysis should be performed for the proposed Project. Also, the City of Fresno responded to the Draft Scope of Work. The City of Fresno noted that access to Temperance Avenue at future Truman Avenue would be limited to northbound left-in, southbound right-in, and eastbound right-out access only. The City of Fresno also requested that the TIA include the intersection of Temperance Avenue and Hamilton Avenue. Finally, on April 6, 2021, Fresno County responded and approved the Draft Scope of Work as presented.

Based on the comments received, this TIA assumes that access to Temperance Avenue at future Truman Avenue will be limited as noted by the City of Fresno. Moreover, this TIA includes the intersection of Temperance Avenue and Hamilton Avenue as requested by the City of Fresno. 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 intersection peak hour turning movement and segment volume counts were conducted at the study intersections and segments in September/November 2020 and February/April 2021, while schools in the vicinity of the Project site were in session. Per communication with City of Fresno staff, expansion factors of 13 percent during the day, 30 percent during the AM peak period and 15 percent during the PM peak period were applied to new traffic counts affected by the global pandemic. The intersection turning movement counts included pedestrian and bicycle volumes. The traffic counts for the existing study intersections are contained in Appendix B. The existing intersection turning movement volumes, intersection geometrics and traffic controls are illustrated in Figure 2.

## *Study Intersections*

| ***Location*** | ***Count Date*** | ***Adjustment*** |
|---|---|---|
| 1. Temperance Avenue / Hamilton Avenue | 04-13-2021 | +30% AM & +15% PM |
| 2. Armstrong Avenue / California Avenue | 02-23-2021 | +30% AM & +15% PM |
| 3. Temperance Avenue / California Avenue (future) | 02-23-2021 | +30% AM & +15% PM |
| 4. Armstrong Avenue / Pitt Avenue | 02-23-2021 | +30% AM & +15% PM |
| 5. Armstrong Avenue / Truman Avenue | 02-23-2021 | +30% AM & +15% PM |
| 6. Temperance Avenue / Truman Avenue (future) | 02-23-2021 | +30% AM & +15% PM |
| 7. Armstrong Avenue / Church Avenue | 02-23-2021 | +30% AM & +15% PM |
| 8. Temperance Avenue / Church Avenue | 02-23-2021 | +30% AM & +15% PM |

# Study Scenarios

## *Existing Traffic Conditions*

This scenario evaluates the Existing Traffic Conditions based on existing traffic volumes and roadway conditions from traffic counts and field surveys conducted in September/November 2020 and February/April 2021, that were adjusted as noted in the aforementioned section.

## *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 developed based on existing travel patterns, the existing roadway network, data provided by SUSD, knowledge of the study area, engineering judgment, existing residential densities, and the *Fresno General Plan* Circulation Element in the vicinity of the Project site.

## *Near Term plus Project Traffic Conditions*

This scenario evaluates the Near Term plus Project Traffic Conditions based on traffic volumes obtained by adding the Near Term related trips to the Existing plus Project Traffic Conditions scenario. It should be noted that this analysis assumes that the west leg of California Avenue connects to Temperance Avenue and also extends west of Armstrong Avenue as part of Tract 5638 included as a Near Term Project.

## *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 the Cumulative Year 2040 plus Project Traffic Conditions based on traffic volumes obtained from using a combination of the Fresno Council of Governments (Fresno COG) activity-based model (ABM) (Base Year 2021 and Cumulative Year 2035) and existing traffic counts. Under this scenario, the increment method, as recommended by the Model Steering Committee was utilized to determine the Cumulative Year 2035 traffic volumes. The Fresno COG ABM plots are contained in Appendix C. Furthermore, JLB utilized the Base Year 2021 and Cumulative Year 2035 volumes along Armstrong Avenue, Temperance Avenue, Church Avenue and Jensen Avenue near the Project site to find an average annual growth rate of 2.0 percent. This growth rate was used to expand the 2035 increment traffic volumes by five (5) years to arrive at the Cumulative Year 2040 plus Project traffic volumes. It should be noted that this analysis assumes that California Avenue extends east of Temperance Avenue by the year 2040 resulting in changes in travel patterns and volumes. The Project Only Trips to the study intersections under cumulative year 2040 were developed based on existing travel patterns, the existing roadway network, data provided by SUSD, knowledge of the study area, engineering judgment, existing residential densities, and the *Fresno General Plan* Circulation Element in the vicinity of the Project site.

## LOS Methodology

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 for the reason that HCM 6th Edition methodologies do not allow the analysis of U-turns. Lane configurations not reflective of existing conditions are a result of software limitations and thus represent a worst-case scenario. Synchro software was used to define LOS in this study. Details regarding these calculations are included in Appendix D.

While LOS is no longer the criteria of significance for traffic impacts under CEQA, the *Fresno General Plan* includes policies that utilize LOS to determine traffic-related improvements that are needed for a project.

## LOS Thresholds

The *Fresno County General Plan* has established LOS C as the acceptable level of traffic congestion on county roads and streets that fall entirely outside the Sphere of Influence (SOI) of a City (Fresno County, 2000). For those areas that fall within the SOI of a City, the LOS threshold of the city is used in this Report. LOS C is used to evaluate the potential LOS impacts to Fresno County intersections that fall outside the City of Fresno SOI. In this case, all study facilities fall within the City of Fresno SOI, therefore, the City of Fresno LOS is utilized.

The *Fresno General Plan* has established various degrees of acceptable LOS on its major streets, which are dependent on four (4) Traffic Impact Zones (TIZ) within the City (City of Fresno 2014). The standard LOS threshold for TIZ I is LOS F, that for TIZ II is LOS E, that for TIZ III is LOS D, and that for TIZ IV is LOS E. Additionally, the 2035 MEIR made findings of overriding consideration to allow a lower LOS threshold than that established by the underlying TIZ's. For those cases in which a LOS criterion for a roadway segment differs from that of the underlying TIZ, such criteria are identified in the roadway description. As all study facilities fall within TIZ III, LOS D is used to evaluate the potential LOS impacts to intersections within this TIA pursuant to the *Fresno General Plan*.

Caltrans endeavors to maintain a target LOS at the transition between LOS C and D on State highway facilities consistent with the *Guide for The Preparation of Traffic Impact Studies* (Caltrans 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, no facilities fall within Caltrans' jurisdiction. Since, all study facilities fall within the City of Fresno SOI, the City of Fresno LOS is utilized.

# VMT Regulatory Settings and Criteria of Significance

Senate Bill (SB) 743 requires that relevant CEQA analysis of transportation impacts be conducted using a metric known as VMT instead of LOS. VMT measures how much actual auto travel (additional miles driven) a proposed project would create on California roads. If the Project adds excessive car travel onto our roads, the Project may cause a significant transportation impact.

The State CEQA Guidelines were amended to implement SB 743, by adding Section 15064.3. Among its provisions, Section 15064.3 confirms that, except with respect to transportation projects, a project's effect on automobile delay shall not constitute a significant environmental impact. Therefore, LOS measures of impacts on traffic facilities are no longer a relevant CEQA criteria for transportation impacts.

CEQA Guidelines Section 15064.3(b)(4) states that "[a] lead agency has discretion to choose the most appropriate methodology to evaluate a project's vehicle miles traveled, including whether to express the change in absolute terms, per capita, per household or in any other measure. A lead agency may use models to estimate a project's vehicle miles traveled, and may revise those estimates to reflect professional judgment based on substantial evidence. Any assumptions used to estimate vehicle miles traveled and any revision to model outputs should be documented and explained in the environmental document prepared for the project. The standard of adequacy in Section 15151 shall apply to the analysis described in this section."

On June 25, 2020, the City of Fresno adopted the *CEQA Guidelines for Vehicle Miles Traveled Thresholds* pursuant to Senate Bill 743 to be effective of July 1, 2020. The City of Fresno *VMT Thresholds* was prepared and adopted consistent with the requirements of CEQA Guidelines Sections 15064.3 and 15064.7. The *Technical Advisory on Evaluating Transportation Impacts in CEQA* (TA) dated December 2018 published by the State of California Governor's Office of Planning and Research (OPR) was utilized as a reference and guidance document in the preparation of the City of Fresno *VMT Thresholds*.

The City of Fresno *VMT Thresholds* adopted a screening standard and criteria that can be used to screen out qualified development projects that meet the adopted criteria from needing to prepare a detailed VMT analysis. These criteria may be size, location, proximity to transit, or trip-making potential. In general, development projects that are consistent with the City's General Plan and Zoning and that that meet one or more of the following criteria can be screened out from a quantitative VMT analysis.

1. Project is located in a Transit Priority Area/High Quality Transit Corridor (within 0.5 miles of a transit stop).
2. Project is local-serving Retail of less than 50,000 square feet.
3. Project is a Low Trip Generator (Less than 500 average daily trips)
4. Project has a High Level of Affordable Housing Units
5. Project is an institutional/Government and Public Service Uses
6. Project is located in a Low VMT Zone

This screening tool is consistent with the OPR December 2018 Guidance referenced above. The screening tool includes an analysis of those portions of the city that satisfy the standard of reducing VMT by 13% from existing per capita and per employee VMT averages within the relevant region. The relevant region adopted by the City of Fresno *VMT Thresholds* is Fresno County.

For projects that are not screened out, a quantitative analysis of VMT impacts must be prepared and compared against the adopted VMT thresholds of significance. The City of Fresno *VMT Thresholds* includes thresholds of significance for development projects, transportation projects, and land use plans. These thresholds of significance were developed using the County of Fresno as the applicable region, and the required reduction of VMT (as adopted in the City of Fresno *VMT Thresholds*) corresponds to Fresno County's contribution to the statewide GHG emission reduction target. In order to reach the statewide GHG reduction target of 15%, Fresno County must reduce its GHG emissions by 13%. The method of reducing GHG by 13% is to reduce VMT by 13% as well.

VMT is simply the product of a number of trips and those trips' lengths. The first step in a VMT analysis is to establish the baseline average VMT, which requires the definition of a region. The City of Fresno *VMT Thresholds* provide that the Fresno County average VMT per Capita (appropriate for residential land uses) and Employee (appropriate for office land uses) are 16.1 and 25.6, respectively. The City's threshold targets a 13%reduction in VMT for residential and office land uses.

The City's adopted thresholds for development projects correspond to the regional thresholds set by the Fresno COG. For residential and non-residential (except retail) development projects, the adopted threshold of significance is a 13% reduction, which means that projects that generate VMT in excess of a 13% reduction from the existing regional VMT per capita or per employee would have a significant environmental impact. Projects that reduce VMT by more than 13% are less than significant. For retail projects, the adopted threshold is any net increase in Regional VMT compared to the existing Regional VMT.

So, the target VMT for residential and office land uses is 14.0 (16.1 X (1-0.13) = 14.0) VMT per capita and 22.3 (25.6 X (1-0.13) = 22.3) VMT per employee, respectively. In addition, for retail land uses the Regional No Project VMT was provided as 23,503,505 by the Fresno COG ABM. The City's threshold targets a net zero (0) increase in Regional VMT for retail land uses (City of Fresno, 2020). In the case of this particular school Project, quantitative assessments of the VMT generated were determined using data provided by SUSD.

# 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
- The number of observed pedestrians at existing intersections was utilized under all baseline study scenarios.
- At existing intersections, the observed Heavy Vehicle Factor (HVF) is utilized in the Existing, Existing plus Project and Near Term plus Project Traffic Conditions scenarios.
- At future intersections, a 3 percent HVF is utilized.
- A 3 percent HVF, or the existing HVF if higher, is utilized in the Cumulative Year 2040 scenarios
- An average of 10 pedestrian calls per hour at study intersections under traffic signal control
- At existing intersections, the observed approach Peak Hour Factor (PHF) is utilized in the Existing, Existing plus Project and Near Term plus Project Traffic Conditions scenarios.
- At future intersections, the following PHFs are utilized in the Existing plus Project and Near Term plus Project scenarios.
  - A PHF of 0.86 during the AM peak
  - A PHF of 0.90 during the PM peak
- A PHF of 0.92, or the existing PHF if higher, is utilized in the Cumulative Year 2040 No Project scenario
- 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 (pre-COVID-19) collected by JLB for intersections in proximity of schools.
  - At the intersection of Temperance Avenue and California Avenue, Temperance Avenue and Truman Avenue, and Temperance Avenue and Church Avenue.
    - A PHF of 0.88 during the AM peak
    - A PHF of 0.90 during the PM peak
  - A PHF of 0.92, or the existing PHF if higher, is utilized during both peak periods at remaining intersections.

# 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.

***Temperance Avenue*** is an existing north-south, two-lane undivided expressway adjacent to the proposed Project. In this area, Temperance Avenue extends south from the City of Clovis SOI and is a four-lane divided expressway between Dakota Avenue and Shields Avenue, a two-lane divided and undivided expressway between Shields Avenue and Clinton Avenue, a three-lane divided expressway between Clinton Avenue and Carmalee Lane, a two-lane undivided expressway between Carmalee Lane and Laurel Avenue, a four-lane divided expressway between Laurel Avenue and Kings Canyon Road, a two-lane undivided expressway between Kings Canyon Road and Butler Avenue, a four-lane divided expressway between Butler Avenue and Hamilton Avenue, a two-lane undivided expressway between Hamilton Avenue and Jensen Avenue, and a two-lane local roadway south of Jensen Avenue through the City of Fresno SOI.

The *Fresno General Plan* Circulation Element designates Temperance Avenue as six-lane super arterial between the City of Clovis SOI and Jensen Avenue, a four-lane super arterial between Jensen Avenue and North Avenue, and a two-lane local roadway south of North Avenue through the City of Fresno SOI. Furthermore, the *Fresno General Plan* Circulation Element acknowledged that Temperance Avenue would exceed LOS D as a six-lane facility between Shields Avenue and McKinley Avenue, State Route 180 and Kings Canyon Road, and Lowe Avenue and Butler Avenue. However, City Council made the appropriate findings to designate LOS E as the criteria of significance for Temperance Avenue as a six-lane facility between Shields Avenue and McKinley Avenue, State Route 180 Westbound Ramps and State Route 180 Eastbound Ramps, and Lowe Avenue and Butler Avenue and LOS F as the criteria of significance for Temperance Avenue as a six-lane facility between State Route 180 Eastbound Ramps and Kings Canyon Road.

***Hamilton Avenue*** is an existing east-west two-lane collector in the vicinity of the proposed Project. In this area, Hamilton Avenue exists as a two-lane collector divided by a two-way left-turn lane between Fowler Avenue and Temperance Avenue. The *Fresno General Plan* Circulation Element designates Hamilton Avenue as a two-lane collector between Fowler Avenue and Temperance Avenue.

***Armstrong Avenue*** is an existing north-south two-lane undivided collector in the vicinity of the proposed Project. In this area, Armstrong Avenue extends south from the City of Clovis SOI between Dakota Avenue and Fancher Creek Avenue and between Kings Canyon Road and North Avenue. Armstrong Avenue is a four-lane divided roadway divided by a two-way left-turn lane between Dakota Avenue and Shields Avenue, a three-lane undivided roadway between Shields Avenue and Princeton Avenue, a two-lane undivided roadway between Princeton Avenue and Floradora Avenue, a three-lane undivided roadway between Floradora Avenue and Olive Avenue, a two-lane undivided roadway between Olive Avenue and Harvey Avenue, a three-lane divided and undivided roadway between Harvey Avenue and Belmont Avenue, a two-lane divided roadway between Belmont Avenue and Fancher Creek Avenue. Additionally, Armstrong Avenue is a three- to four-lane undivided collector between Kings Canyon Road and Hamilton Avenue, a four-lane collector divided by a two-way left-turn lane between Hamilton Avenue and Woodward Avenue, a three-lane collector divided by a two-way left-turn lane between Woodward Avenue and Truman Avenue, a two-lane undivided collector between Truman Avenue and North Avenue.

The *Fresno General Plan* Circulation Element designates Armstrong Avenue as two-lane collector between the City of Clovis SOI and Belmont Avenue, a four-lane collector between Kings Canyon Road and Jensen Avenue, and a two-lane collector between Jensen Avenue and North Avenue. Furthermore, the *Fresno General Plan* Circulation Element acknowledged that Armstrong Avenue would exceed LOS D as a two-lane facility between McKinley Avenue and Olive Avenue. However, City Council made the appropriate findings to designate LOS E as the criteria of significance for Armstrong Avenue as a two-lane facility between McKinley Avenue and Olive Avenue.

***California Avenue*** is an existing east-west four-lane collector in the vicinity of the proposed Project. In this area, California Avenue exists between Armstrong Avenue and approximately 100 feet west of Temperance Avenue. The *Fresno General Plan* Circulation Element designates California Avenue as a four-lane collector between Fowler Avenue and Temperance Avenue. Based on information provided by City of Fresno staff, the easterly extension of California Avenue to Temperance Avenue will be constructed and operational by late 2022/early 2023.

***Pitt Avenue*** is an existing east-west two-lane local street in the vicinity of the proposed Project. In this area, Pitt Avenue exists between Armstrong Avenue and Apricot Avenue and will serve as the principal access to the proposed Project from Armstrong Avenue given the direct access. The *Fresno General Plan* Circulation Element designates Pitt Avenue as two-lane local street between Armstrong Avenue and Apricot Avenue.

***Truman Avenue*** is an existing east-west two-lane local street adjacent to the proposed Project. In this area, Truman Avenue exists between Armstrong Avenue and Apricot Avenue and will serve as the secondary access to the proposed Project from Armstrong Avenue given its bends and traffic calming measures. The Project also proposes to construct Truman Avenue as a local two-lane local roadway adjacent to the Project site between Temperance Avenue and McKelvey Avenue. The *Fresno General Plan* Circulation Element designates Truman Avenue as two-lane local street between Armstrong Avenue and Temperance Avenue.

***Church Avenue*** is an existing east-west two-lane collector in the vicinity of the proposed Project site. In this area, Church Avenue exists a two-lane undivided collector west of Marks Avenue and between Marks Avenue and Elm Avenue, a two-lane collector divided by a two-way left-turn lane between Elm Avenue and Golden State Boulevard, a four-lane undivided collector between Golden State Boulevard and Halloway Avenue, a three-lane collector divided by a two-way left-turn lane between Halloway Avenue and Maple Avenue, a two-lane undivided collector between Maple Avenue and Peach Avenue, a three-lane undivided collector between Peach Avenue and Villa Avenue, a four-lane collector divided by a two-way left-turn lane between Villa Avenue and Sunnyside Avenue, a three-lane divided collector between Sunnyside Avenue and Fowler Avenue, a two-lane undivided collector between Fowler Avenue and Temperance Avenue, and a two-lane undivided roadway between Temperance Avenue and Leonard Avenue. The *Fresno General Plan* Circulation Element designates Church Avenue as two-lane collector between Marks Avenue and Clara Avenue, a four-lane collector between Clara Avenue and Willow Avenue, a two-lane collector between Willow Avenue and Highland Avenue. Furthermore, the *Fresno General Plan* Circulation Element acknowledged that Church Avenue would exceed LOS D as a two-lane facility between Fig Street and Clara Avenue. However, City Council made the appropriate findings to designate LOS E as the criteria of significance for Church Avenue as a two-lane facility between Fig Street and Clara Avenue.

## Collision Analysis

JLB conducted a search of the Statewide Integrated Traffic Records System (SWITRS) to obtain collision reports for the most recent five-year period (January 1, 2016 to December 31, 2020). The SWITRS "is a database that serves as a means to collect and process data gathered from a collision scene. The internet SWITRS application is a tool by which the California Highway Patrol (CHP) staff and members of its Allied Agencies throughout California can request various types of statistical reports in an electronic format." All collision reports between January 1, 2016 and December 31, 2020 were included in the collision analysis. In the five-year period, a total of 30 collisions were reported within the influence zone (assumed to be within 250 feet) of the study intersections. The SWITRS collision data are found in Appendix E.

Table I summarizes the type of collision, severity, violation, and identifies involvement with another vehicle, a pedestrian/bicyclist or a fixed object. Based on the five-year collision data contained within SWITRS, most study intersections have experienced a low number and severity of collisions per year. However, the intersection of Armstrong Avenue and Church Avenue has experienced an average of two broadside collisions per year. When considering the inherent factors of the collisions at the intersection of Armstrong Avenue and Church Avenue, it is worth noting that the traffic control at this location was modified from two-way stop to all-way stop control in September 2019. After thorough review of the data contained within the collision reports for the five-year analysis period, the modification to all-way stop control has reduced the number and severity of broadside collisions and therefore further changes to the existing traffic controls is not recommended under the existing conditions for the intersection of Armstrong Avenue and Church Avenue.

The intersection of Temperance Avenue and Church Avenue has experienced approximately two broadside collisions per year since 2018. However, between July 1, 2019 and June 30, 2020 this intersection experienced a total of five collisions that can be correctable by the implementation of all-way stop traffic controls. Based on the data within the SWITRS reports, three of the five collisions were likely a result of limited line-of-sight to the north for eastbound traffic due to vegetation at the property located on the northwest corner of the intersection. When considering the inherent factors of these collisions, JLB recommends that Fresno County conduct a corner sight distance evaluation pursuant to Chapter 400 of the latest edition of the *California Highway Design Manual* (CA HDM). If the existing available corner sight distance does not satisfy current standards, then Fresno County can determine if and how to accommodate the minimum corner sight distance requirement or consider implementing an all-way stop control at the intersection of Temperance Avenue and Church Avenue in order to improve traffic safety.

**Table I: Five-Year (2016-2020) Intersection Collision Analysis**

| ID | Intersection | Number of Collisions | Type of Collision | | | | | | Severity | | | | | Type of Violation | | | | | | | | Motor Vehicle Involved with... | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Broadside | Rear End | Head-On | Hit Object | Sideswipe | Other | Fatal | Severe Injury | Other Visible Injury | Complaint of Pain Injury | Property Damage Only | Traffic Signals & Signs | Right of Way | Unsafe Speed | Improper Turning | Driving Under Influence | Too Close | Pedestrian Violation | Other | Pedestrian/Bicyclist | Other Motor Vehicle | Fixed Object | Other |
| 1 | Temperance Avenue / Hamilton Avenue | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | Armstrong Avenue / California Avenue | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | Armstrong Avenue / Pitt Avenue | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | Armstrong Avenue / Truman Avenue | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| 7 | Armstrong Avenue / Church Avenue | 18 | 12 | 2 | - | 2 | 2 | - | - | - | 2 | 3 | 13 | 1 | 10 | 2 | 3 | 2 | - | - | - | - | 16 | 2 | - |
| 8 | Temperance Avenue / Church Avenue | 11 | 7 | 1 | - | 1 | - | 2 | - | 1 | - | 1 | 9 | 1 | 6 | 1 | 3 | - | - | - | - | - | 9 | 2 | - |

## Traffic Signal Warrants

The CA MUTCD indicates that an engineering study of traffic conditions, pedestrian characteristics and physical features of an intersection shall be conducted to determine whether installation of traffic signal controls are justified. The CA MUTCD provides a total of nine (9) warrants to evaluate the need for traffic signal controls. These warrants include 1) Eight-Hour Vehicular Volume, 2) Four-Hour Vehicular Volume, 3) Peak Hour, 4) Pedestrian Volume, 5) School Crossing, 6) Coordinated Signal System, 7) Crash Experience, 8) Roadway Network and 9) Intersection Near a Grade Crossing. Signalization of an intersection may be appropriate if one or more of the signal warrants is satisfied. However, the CA MUTCD also states that "[t]he satisfaction of a signal warrant or warrants shall not in itself require the installation of a traffic control signal" (Caltrans 2020).

If traffic signal warrants are satisfied when a LOS threshold impact is identified at an unsignalized intersection, then installation of a traffic signal control may serve as an improvement measure. For instances where traffic signal warrants are satisfied, a traffic signal control is not considered to be the default improvement measure. Since installation of a traffic signal control typically requires construction of additional lanes, an attempt is made to improve the intersection approach lane geometrics in order to improve its LOS while maintaining the existing intersection controls. If the additional lanes did not result in acceptable LOS at the intersection, then in those cases implementation of a traffic signal control would be considered.

Warrants 1, 2 and 3 were prepared for the unsignalized intersections under the Existing Traffic Conditions scenario. These warrants are contained in Appendix K. Under this scenario, only the intersection of Temperance Avenue and Hamilton Avenue satisfies Warrant 1, Warrant 2 and Warrant 3 during both peak periods. Based on the traffic signal warrants, operational analysis and engineering judgement, it is not recommended that the city consider implementing traffic signal controls at any of the unsignalized study intersections especially since these operate at an acceptable LOS during both peak periods under stop sign control.

## 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 F. Table II 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.

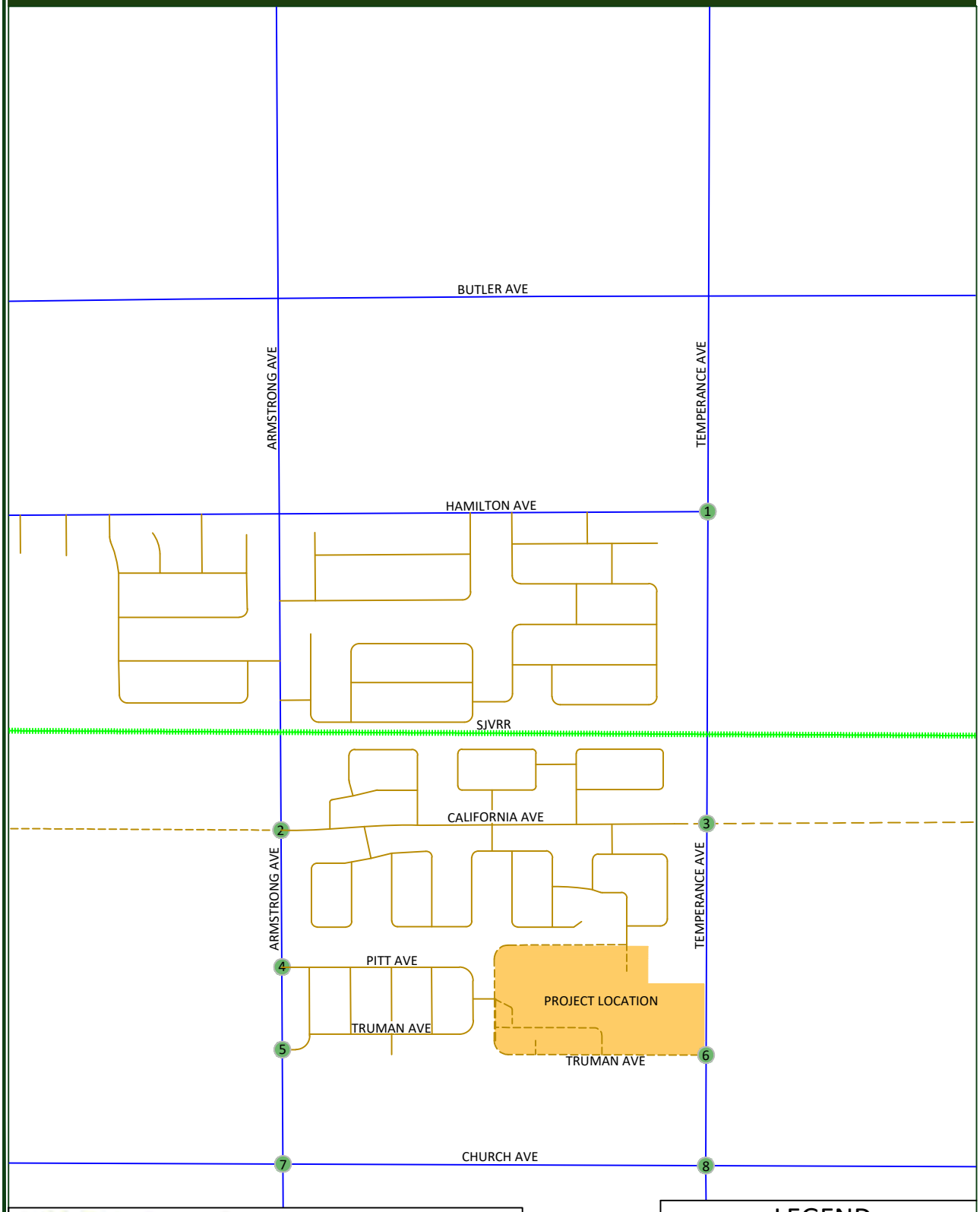
### Table II: Existing Intersection LOS Results

| *ID* | *Intersection* | *Intersection Control* | *AM (7-9) Peak Hour* | | *PM (4-6) Peak Hour* | |
|---|---|---|---|---|---|---|
| | | | *Average Delay (sec/veh)* | *LOS* | *Average Delay (sec/veh)* | *LOS* |
| 1 | Temperance Avenue / Hamilton Avenue | All-Way Stop | 20.1 | C | 11.3 | B |
| 2 | Armstrong Avenue / California Avenue | One-Way Stop | 10.9 | B | 10.3 | B |
| 3 | Temperance Avenue / California Avenue | Does Not Exist | N/A | N/A | N/A | N/A |
| 4 | Armstrong Avenue / Pitt Avenue | One-Way Stop | 10.0 | B | 9.1 | A |
| 5 | Armstrong Avenue / Truman Avenue | One-Way Stop | 11.5 | B | 9.9 | A |
| 6 | Temperance Avenue / Truman Avenue | Does Not Exist | N/A | N/A | N/A | N/A |
| 7 | Armstrong Avenue / Church Avenue | All-Way Stop | 17.5 | C | 7.8 | A |
| 8 | Temperance Avenue / Church Avenue | Two-Way Stop | 13.3 | B | 12.5 | 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.

# SUSD Elementary School
# Vicinity Map

Figure 1

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## LEGEND

(#) = STUDY INTERSECTION

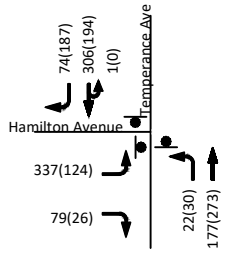
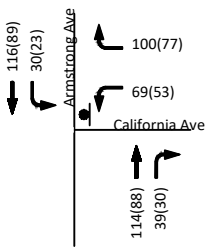
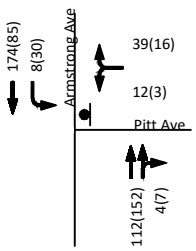
= FUTURE ROADWAY

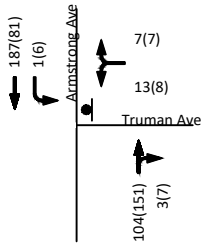
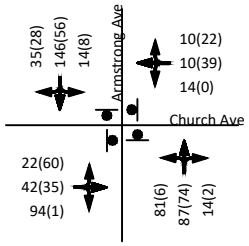
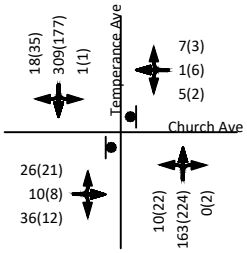
N

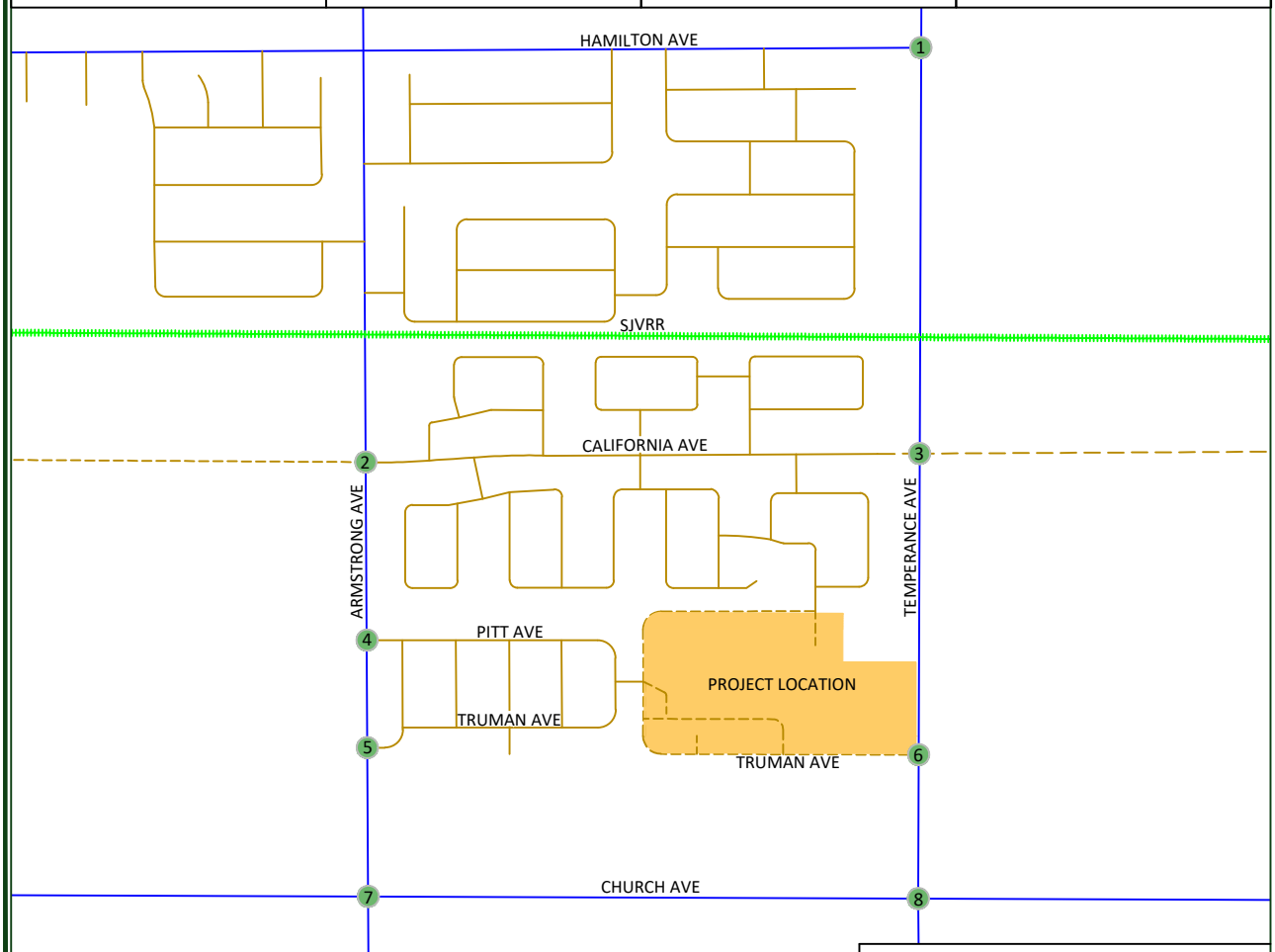
Not To Scale

# SUSD Elementary School
# Existing - Traffic Volumes, Geometrics and Controls

Figure 2

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  | DOES NOT EXIST |  |

| 5. Armstrong Ave & Truman Ave | 6. Temperance Ave & Truman Ave | 7. Armstrong Ave & Church Ave | 8. Temperance Ave & Church Ave |
|---|---|---|---|
|  | DOES NOT EXIST |  |  |

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## LEGEND

- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PEAK HOUR TRIPS
- (XX) = PM PEAK HOUR TRIPS
- = STOP SIGN

N

Not To Scale

# Existing plus Project Traffic Conditions

## Project Description

The Project proposes to a) construct administrative offices, classrooms, a multi-purpose building, and physical education facilities/outdoor play areas, b) include approximately 45 employees, including administrators, faculty, and support staff, and c) serve approximately 700 students in transitional kindergarten through sixth grades. The timing for the construction of the Project is estimated to be in approximately three to five years to coincide with the planned surrounding development. 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 existing local streets south of California Avenue and east of Armstrong Avenue. Moreover, the Project proposes to construct future Truman Avenue extending west of Temperance Avenue. Existing roadways, including Shelly Avenue, Bridle Avenue and Arroyo Avenue can be accessed from California Avenue to arrive at the northern edge of the Project site. Access at the northern edge of the Project site leads to a cul-de-sac with a pedestrian gate to the campus. Existing roadways including Pitt Avenue and Truman Avenue can be accessed from Armstrong Avenue to arrive at the western edge of the Project site. Access at the western edge of the Project site leads to the bus drop-off aisle and staff parking lot to the north of the campus. Moreover, the same access at the western edge of the Project site leads to a parking lot across from the kindergarten classroom. Also, the Project proposes to construct future Truman Avenue west of Temperance Avenue approximately 700 feet north of Church Avenue. Future Truman Avenue will have Project driveways approximately located 650 feet and 1,000 feet west of Temperance Avenue. The eastern access along Truman Avenue provides access to the parking lot located along the north side of Truman Avenue and serves as the principal access to a parent drop-off aisle. The parent drop-off exit is located along the western edge of the Project site.

JLB analyzed a prior version of the Project Site Plan after which it was recommended that the Project incorporate changes to the site plan. In this case, it was recommended that the Project a) add a secondary access point to the parking lot located along the north side of Truman Avenue and b) modify the parent drop-off exit to add a dedicated left-turn lane and right-turn lane and redesign the exit to encourage traffic toward Temperance Avenue as opposed to the neighborhood streets adjacent to the Project site. The latest Project Site Plan integrates these recommendations. Moreover, 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 III presents the trip generation for the proposed Project with trip generation rates for 700 Elementary School students. At build-out, the Project is estimated to generate a maximum of 1,323 daily trips, 469 AM peak hour trips and 119 PM peak hour trips.

### Table III: Project Trip Generation

| *Land Use (ITE Code)* | *Size* | *Unit* | *Daily* | | *AM (7-9) Peak Hour* | | | | | | *PM (4-6) Peak Hour* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Rate* | *Total* | *Trip Rate* | *In* | *Out* | *In* | *Out* | *Total* | *Trip Rate* | *In* | *Out* | *In* | *Out* | *Total* |
| | | | | | | *%* | | | | | | *%* | | | | |
| Elementary School (520) | 700 | students | 1.89 | 1,323 | 0.67 | 54 | 46 | 253 | 216 | 469 | 0.17 | 48 | 52 | 57 | 62 | 119 |
| ***Total Driveway Trips*** | | | | **1,323** | | | | **253** | **216** | **469** | | | | **57** | **62** | **119** |

## Trip Distribution

The Project Only Trips to the study intersections were developed based on existing travel patterns, the existing roadway network, data provided by SUSD, knowledge of the study area, engineering judgment, existing residential densities, and the *Fresno General Plan* Circulation Element in the vicinity of the Project site. Figure 4 illustrates the Project Only Trips to the study intersections and Figure 5 illustrates the Project Only Trips to Project driveways.

## Active Transportation Plan

The Fresno *Active Transportation Plan* (ATP) adopted December 2016 outlines the City's vision for active transportation in which a complete, safe and comfortable network of trails, sidewalks, and bikeways serve all residents of Fresno. This *ATP* updates and succeeds the City of Fresno Bicycle, Pedestrian, & Trails, Master Plan that was adopted in 2010. The *ATP* aims to a) improve the safety of walking and bicycling, b) create user-friendly facilities to promote walking and bicycling, c) expand access to walking and bicycling facilities, and d) fill key gaps in the walking and bicycling networks in Fresno.

In order to achieve these goals for active transportation, the ATP proposes a comprehensive network of citywide bikeways, trails and sidewalks. The recommended network would add 166 miles of Class I Bike Paths, 691 miles of Class II Bike Lanes, 69 miles of Class III Bike Routes, 21 miles of Class IV Separated Bikeways, and 661 miles of sidewalks. This ATP also recommends bicycle detection at traffic signals, destination signage, bicycle parking, showers and changing facilities and bikeway maintenance. This network will be constructed in conjunction with adjacent land developments, roadway maintenance and active transportation infrastructure projects using funds from different local, state and federal sources.

## Bikeways

The Fresno *ATP* classifies bicycle facilities into the following types:

- Class I Bikeway (Bike Path) – Provides a completely separated right-of-way for exclusive use of bicycles and pedestrians with crossflow minimized.
- Class II Bikeway (Bike Lane) – Provides a striped lane for one-way bike travel on a street or highway.
- Class III Bikeway (Bike Route) – Provides a shared use with pedestrians or motor vehicle traffic, typically on lower volume roadways.
- Class IV Bikeways (Separated Bikeways) – Provides a protected lane for one-way bike travel (one-way cycle track) and protected lanes for two-way bike travel (two-way cycle track) on a street or highway.

In the vicinity of the Project site, Class II Bikeways exist along portions of Armstrong Avenue, Hamilton Avenue, California Avenue and Church Avenue. The *Fresno ATP* recommends that a combination of Class I and Class II Bikeways be implemented adjacent to and in the vicinity of the Project site (City of Fresno 2016). Adjacent to the Project site, Class I Bikeways are recommended along the west side of Temperance Avenue. Also, Class II Bikeways are recommended along Temperance Avenue adjacent to the Project site. In the vicinity of the Project site, Class II Bikeways are recommended along remaining portions of Armstrong Avenue, Temperance Avenue, California Avenue and Church Avenue. Therefore, it is recommended that the Project implement Class I and Class II Bikeways along its frontage to Temperance Avenue consistent with the *Fresno ATP*.

## Walkways

The *Fresno ATP* classifies pedestrian facilities as either sidewalk or Class I Bike Paths, which allow for exclusive use of bicyclists and pedestrians. Pedestrian sidewalks exist adjacent to and in the vicinity of the Project site. Adjacent to the Project site, pedestrian sidewalks exist to the west of the Project site within Tract 6095 and to the north of the Project site within Tract 5531. Moreover, pedestrian sidewalks exist along portions of Armstrong Avenue, Hamilton Avenue, California Avenue, Pitt Avenue and Truman Avenue.

The *Fresno ATP* recommends that pedestrian sidewalks and Class I Bike Paths be implemented adjacent to and in the vicinity of the Project site. In this case, the Project proposes to construct pedestrian sidewalks along the Project's frontage to Truman Avenue. Adjacent to the Project site, a Class I Bike Path is recommended along the Project's frontage to Temperance Avenue. In the vicinity of the Project site, pedestrian sidewalks are recommended along remaining portions of Armstrong Avenue, California Avenue, Temperance Avenue and Church Avenue. In addition, it is recommended that the Project implement pedestrian sidewalks and Class I Bike Paths consistent with the Fresno *ATP* within and adjacent to the Project site. Adjacent to the Project site, it is recommended that the Project implement pedestrian sidewalks along future portions of Truman Avenue. Moreover, it is recommended that the Project implement a Class I Bike Path along its frontage to Temperance Avenue.

## Transit

Fresno Area Express (FAX) is the transit operator in the City of Fresno (Department of Transportation FAX, 2021). At present, there are no FAX transit routes that operate adjacent to or in the vicinity of the Project.

Fresno County Rural Transit Agency (FCRTA) provides transit services for those communities not served by FAX, Stageline or Round Up. FCRTA set up Orange Cove Inter-City Transit to provide scheduled round trip inter-city service through Orange Cove, Reedley, Parlier, Sanger, and the Fresno-Clovis Metropolitan Area Monday through Friday from 7:00 AM to 5:28 PM. The stops within the Project vicinity are limited to the Social Service Department, the Amtrak/Greyhound Station, and the Fresno County Public Library. It is worth noting retention of the existing and expansion of future transit routes is dependent on transit ridership demand and available funding.

## Vehicle Miles Traveled Analysis

Based on data provided by SUSD, the Project is located within a defined service area generally bound by Fowler Avenue, Hamilton Avenue, Temperance Avenue and Church Avenue to the west of Temperance Avenue and generally bound by Temperance Avenue, Tulare Avenue, McCall Avenue and Jensen Avenue to the east of Temperance Avenue. Moreover, the area is currently being served by other schools including Hallmark Charter School (Hallmark) located on the southeast quadrant of Bethel Avenue and Jensen Avenue in the City of Sanger, Jackson Elementary School (Jackson) located on the northwest quadrant of Academy Avenue and Jensen Avenue in the City of Sanger, Madison Elementary School (Madison) located on the northeast quadrant of Bethel Avenue and North Avenue in the City of Sanger, Sanger Academy Charter (Sanger Academy) located on the southeast quadrant of Bethel Avenue and Jensen Avenue in the City of Sanger, Sequoia Elementary School (Sequoia) located on the northeast quadrant of Armstrong Avenue and Jensen Avenue in the City of Fresno, John S. Wash Elementary School (John Wash) located on the southwest quadrant of Armstrong Avenue and Kings Canyon Road in the City of Fresno, Quail Lake Charter School (Quail Lake) located on the northwest corner of Quail Lake Drive and Ashlan Avenue in the City of Clovis, Centerville Elementary School (Centerville) located on the southeast corner of Smith Avenue and State Route 180 in the City of Sanger, Del Rey School (Del Rey) located on the northwest corner of Morro Avenue and Jefferson Avenue in the City of Del Rey, Lincoln Elementary School (Lincoln) located on the northeast quadrant of Greenwood Avenue and North Avenue in the City of Sanger, Lone Star Elementary School (Lone Star) located on the northwest quadrant of Fowler Avenue and North Avenue in the City of Fresno, Wilson Elementary School (Wilson) located on the southeast quadrant of Academy Avenue and Jensen Avenue in the City of Sanger.

At present, the average VMT to existing schools is 3.4 miles (round-trip). Upon completion of the Project, the average VMT is projected to be 2.4 miles (round-trip). Considering the Project is located in an area surrounded by residential land uses with adequate walking and bicycle facilities, it is anticipated that a majority of children will walk and bike to the Project site further reducing the Project's transportation VMT impact. Therefore, the Project is presumed to create a less than significant impact.

## Safe Routes to School

The most direct path to the Project site for students residing in the general area bound by Fowler Avenue, Hamilton Avenue, Temperance Avenue and Church Avenue would be to utilize a combination of local streets and major roadways to arrive at major roadways such as Fowler Avenue, Armstrong Avenue, Temperance Avenue, Hamilton Avenue, California Avenue, or Church Avenue. Once students have arrived at these major roadways, students may proceed towards the intersections of Temperance Avenue and Hamilton Avenue, Armstrong Avenue and California Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue.

The intersection of Temperance Avenue and Hamilton Avenue is controlled by all-way stop signs and contains unmarked crosswalks along Temperance Avenue. Students arriving at this intersection may proceed southbound along the west side of Temperance Avenue towards the intersection of Temperance Avenue and California Avenue. Based on information provided by City of Fresno staff, the extension of California Avenue east to Temperance Avenue is anticipated to be completed by early 2023. Moreover, it is anticipated that the intersection of Temperance Avenue and California Avenue will be controlled by a one-way stop sign on California Avenue. Students may proceed westbound along the south side of California Avenue towards the intersection of Arroyo Avenue and California Avenue. The intersection of Arroyo Avenue and California Avenue is controlled by a one-way stop sign on Arroyo Avenue and contains unmarked crosswalks on all approaches. Students may proceed to use the local streets south of California Avenue to arrive at the northern edge of the Project site that leads to a cul-de-sac access with a pedestrian gate to the campus.

The intersection of Armstrong Avenue and California Avenue is controlled by a one-way stop sign on California Avenue and contains unmarked crosswalks along Armstrong Avenue. Students arriving at this intersection may proceed southbound along the east side of Armstrong Avenue towards the intersection of Armstrong Avenue and Pitt Avenue. The intersection of Armstrong Avenue and Pitt Avenue is controlled by a one-way stop sign on Pitt Avenue and contains unmarked crosswalks on all approaches. Students may proceed to use the local streets east of Armstrong Avenue to arrive at the western edge of the Project site that leads to the nearest campus entrance.

The intersection of Armstrong Avenue and Church Avenue is controlled by all-way stop signs and contains unmarked crosswalks on all approaches. Students arriving at this intersection may proceed northbound along the east side of Armstrong Avenue toward the intersection of Armstrong Avenue and Truman Avenue. The intersection of Armstrong Avenue and Truman Avenue is controlled by a one-way stop sign on Pitt Avenue and contains unmarked crosswalks on all approaches. Students may proceed to use the local streets east of Armstrong Avenue to arrive at the western edge of the Project site that leads to the nearest campus entrance.

The intersection of Temperance Avenue and Church Avenue is controlled by two-way stop signs on Church Avenue approaches and contains unmarked crosswalks on all approaches. Students arriving at this intersection may proceed northbound along the west side of Temperance Avenue toward the intersection of Temperance Avenue and Truman Avenue. The intersection of Temperance Avenue and Truman is anticipated to be controlled by a one-way stop sign on Truman Avenue. Students may proceed westbound along the north side of Truman Avenue until reaching the nearest campus entrance.

Most of the areas immediately to the north and west of the Project site are well-developed with walkways and intersection controls. However, there are a few areas west of Armstrong and south of the Project site that remain undeveloped. Therefore, in order to promote alternative modes of transportation to and from the Project site and improve student safety, it is recommended that SUSD work with the City of Fresno 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 Fresno, and subsequently implemented prior to opening day of the school component of the Project.

## Traffic Signal Warrants

Warrant 3 was prepared for the unsignalized intersections under the Existing plus Project Traffic Conditions scenario. These warrants are contained in Appendix K. Under this scenario, no unsignalized study intersection is projected to satisfy Warrant 3 during both peak periods. However, the intersections of Temperance Avenue and Hamilton Avenue and Temperance Avenue and California Avenue are projected to satisfy Warrant 3 during the AM peak period only. Based on the traffic signal warrants, operational analysis and engineering judgement, it is not recommended that the city consider implementing traffic signal controls at any of the unsignalized study intersections especially since these are projected to operate at an acceptable LOS during both peak periods under stop sign control.

## Roadway Network

The Existing plus Project Traffic Conditions scenario assumes that the existing roadway geometrics and traffic controls will remain in place with a few exceptions. Based on information provided by City of Fresno staff, this scenario assumes that the extension of California Avenue east to Temperance Avenue is completed by early 2023. Moreover, it is anticipated that the intersection of Temperance Avenue and California Avenue will be controlled by a one-way stop sign on California Avenue. In addition, the Project will construct future Truman Avenue approximately 700 feet north of Church Avenue. Based on details provided by City of Fresno staff, the intersection of Temperance Avenue and Truman Avenue will be limited to northbound left-in, southbound right-in and eastbound right-out only. Lastly, it is anticipated that the Project will build its frontage improvements to Temperance Avenue. Figure 6 illustrates the assumed intersection geometrics and traffic controls for these intersections under this scenario.

## Results of Existing plus Project Level of Service Analysis

The Existing plus Project Traffic Conditions scenario assumes that the intersections of Temperance Avenue and California Avenue and Temperance Avenue and Truman Avenue are constructed and operational. Figure 6 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 G. Table IV 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.

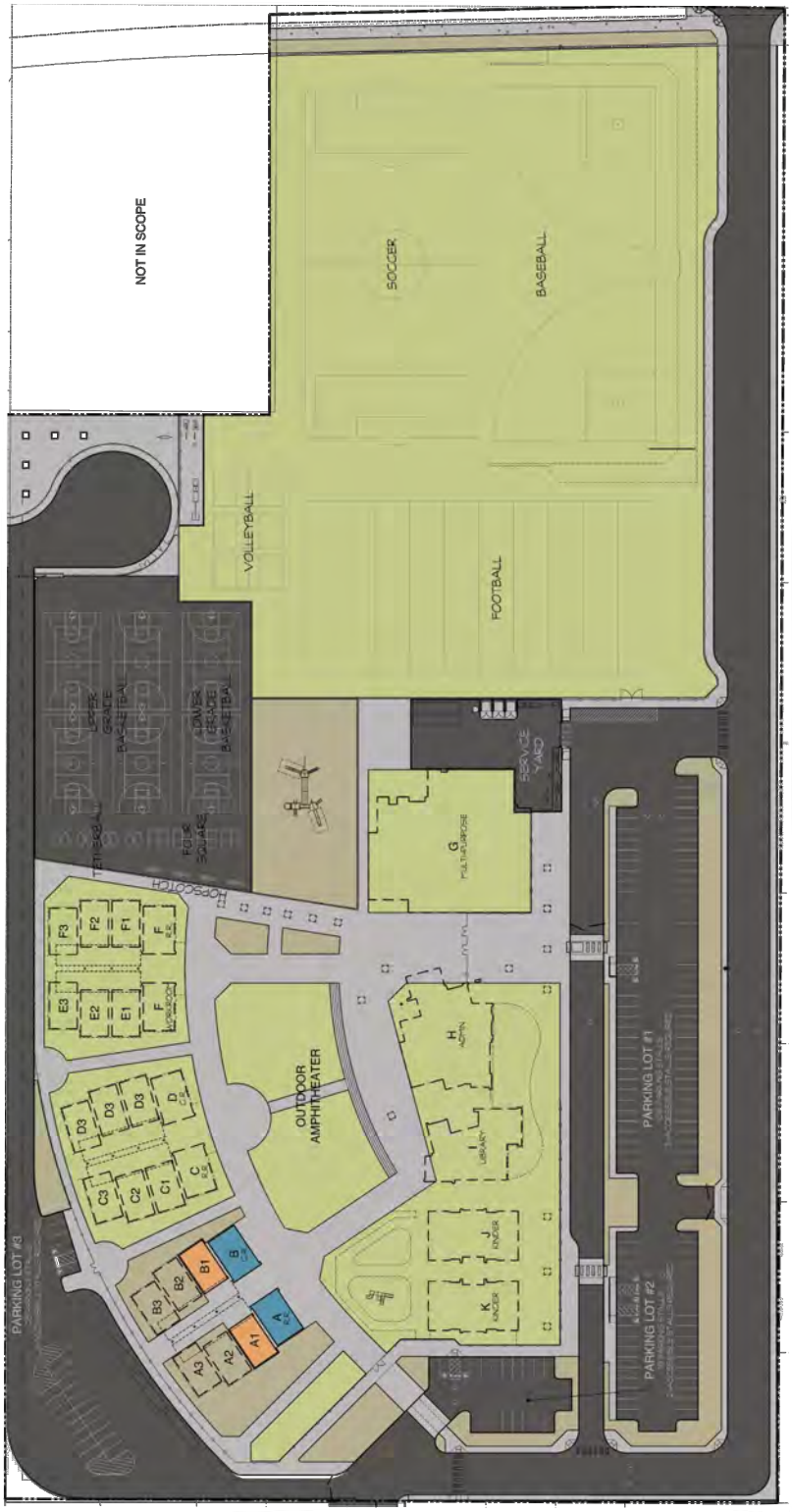
### Table IV: Existing plus Project Intersection LOS Results

| *ID* | *Intersection* | *Intersection Control* | *AM (7-9) Peak Hour* | | *PM (4-6) Peak Hour* | |
|---|---|---|---|---|---|---|
| | | | *Average Delay (sec/veh)* | *LOS* | *Average Delay (sec/veh)* | *LOS* |
| 1 | Temperance Avenue / Hamilton Avenue | All-Way Stop | 20.1 | C | 12.2 | B |
| 2 | Armstrong Avenue / California Avenue | One-Way Stop | 11.3 | B | 10.0 | B |
| 3 | Temperance Avenue / California Avenue | One-Way Stop | 15.8 | C | 13.2 | B |
| 4 | Armstrong Avenue / Pitt Avenue | One-Way Stop | 10.7 | B | 9.2 | A |
| 5 | Armstrong Avenue / Truman Avenue | One-Way Stop | 12.0 | B | 9.8 | A |
| 6 | Temperance Avenue / Truman Avenue | One-Way Stop | 12.0 | B | 9.6 | A |
| 7 | Armstrong Avenue / Church Avenue | All-Way Stop | 15.7 | C | 7.8 | A |
| 8 | Temperance Avenue / Church Avenue | Two-Way Stop | 16.5 | C | 13.1 | 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.

# SUSD Elementary School
# Project Site Plan

Figure 3





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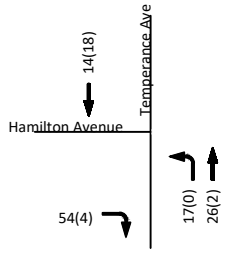
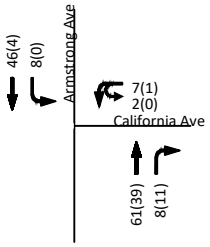
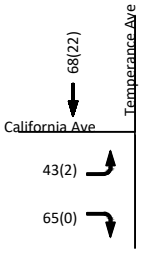
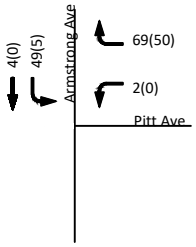
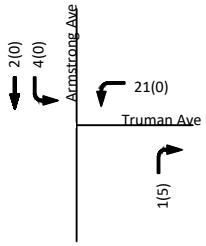
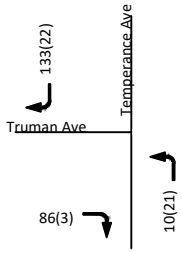
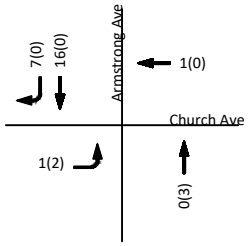
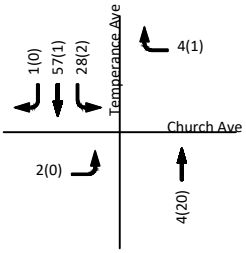
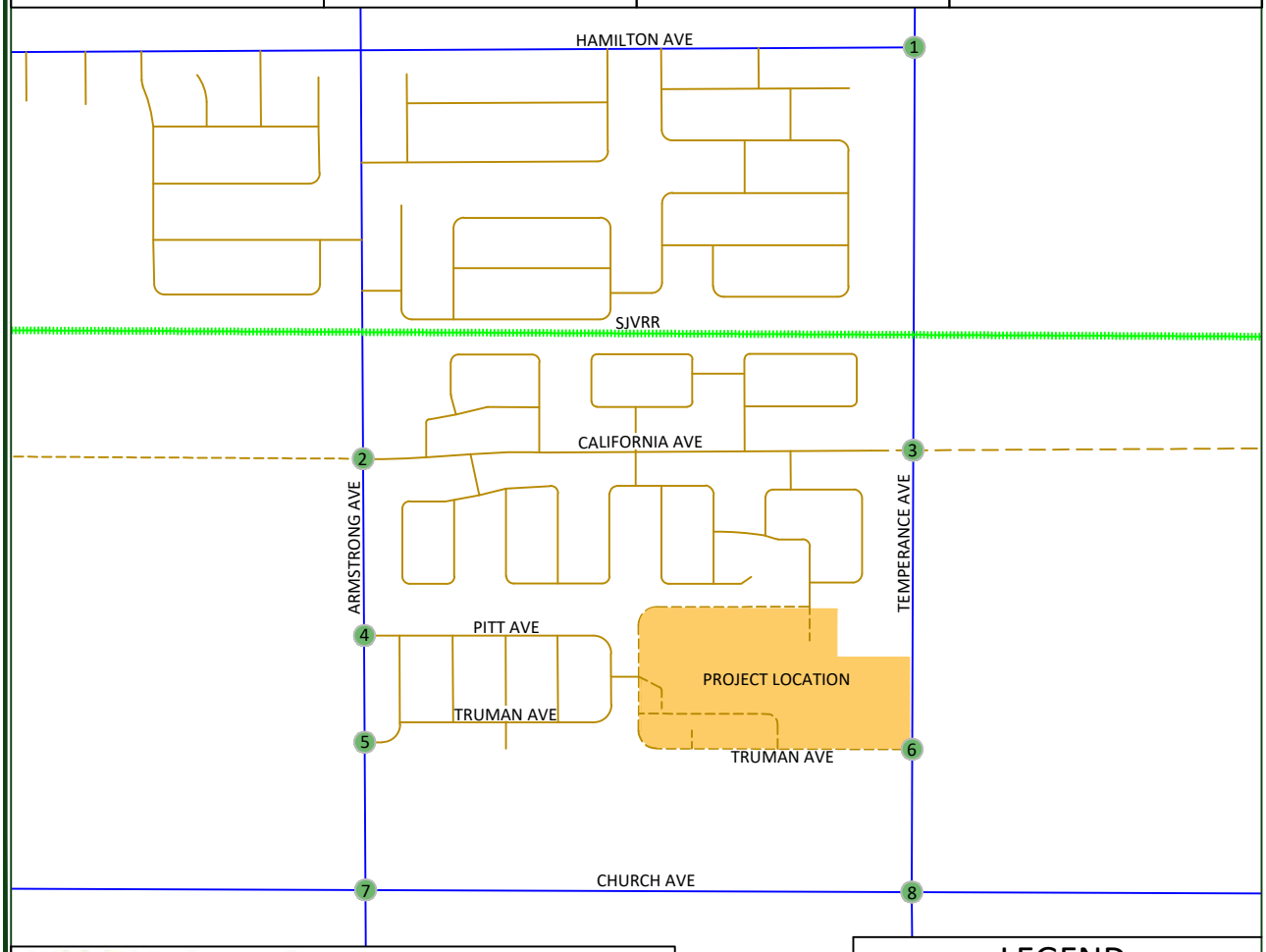
Not To Scale

# SUSD Elementary School
# Project Only Trips

Figure 4

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  |  |  |
| **5. Armstrong Ave & Truman Ave** | **6. Temperance Ave & Truman Ave** | **7. Armstrong Ave & Church Ave** | **8. Temperance Ave & Church Ave** |
|  |  |  |  |





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## LEGEND

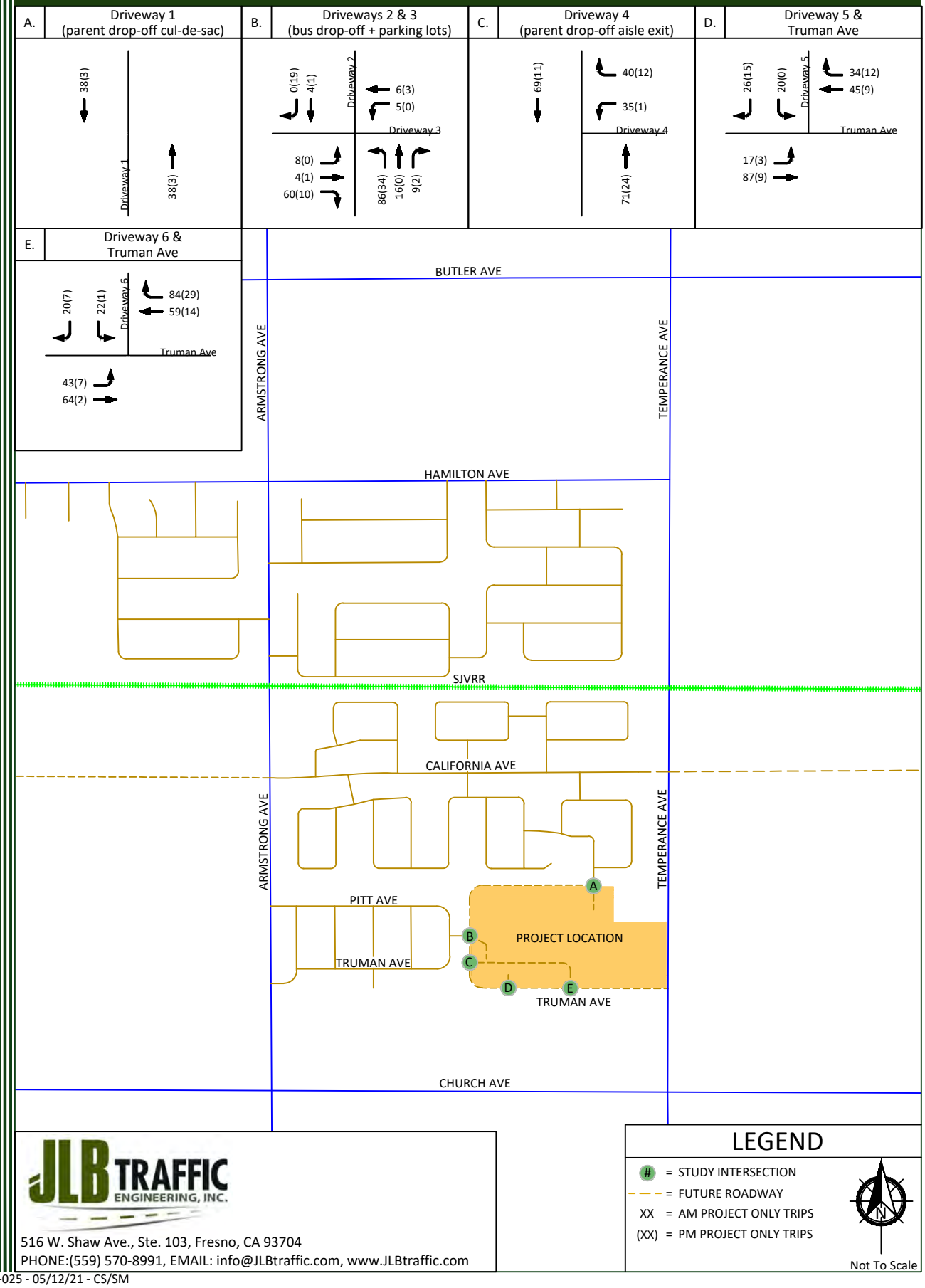
- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PROJECT ONLY TRIPS
- (XX) = PM PROJECT ONLY TRIPS

N

Not To Scale

# SUSD Elementary School
# Project Only Trips (Driveways)

Figure 5

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N

Not To Scale


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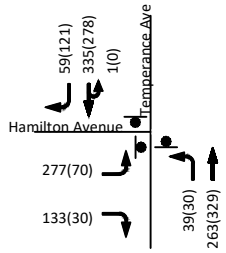
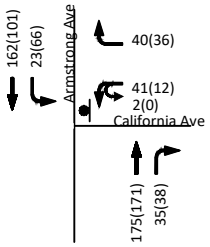
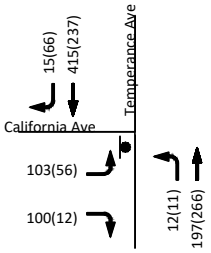
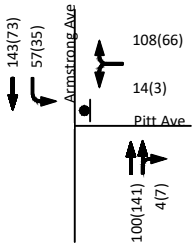
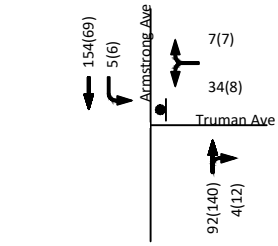
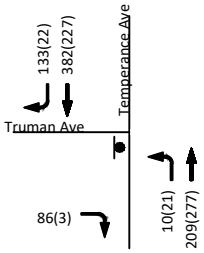
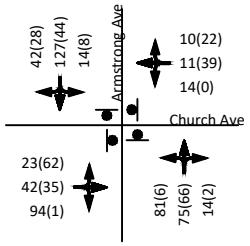
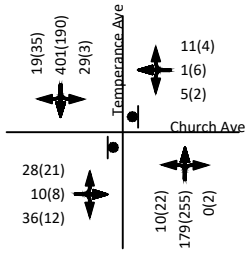
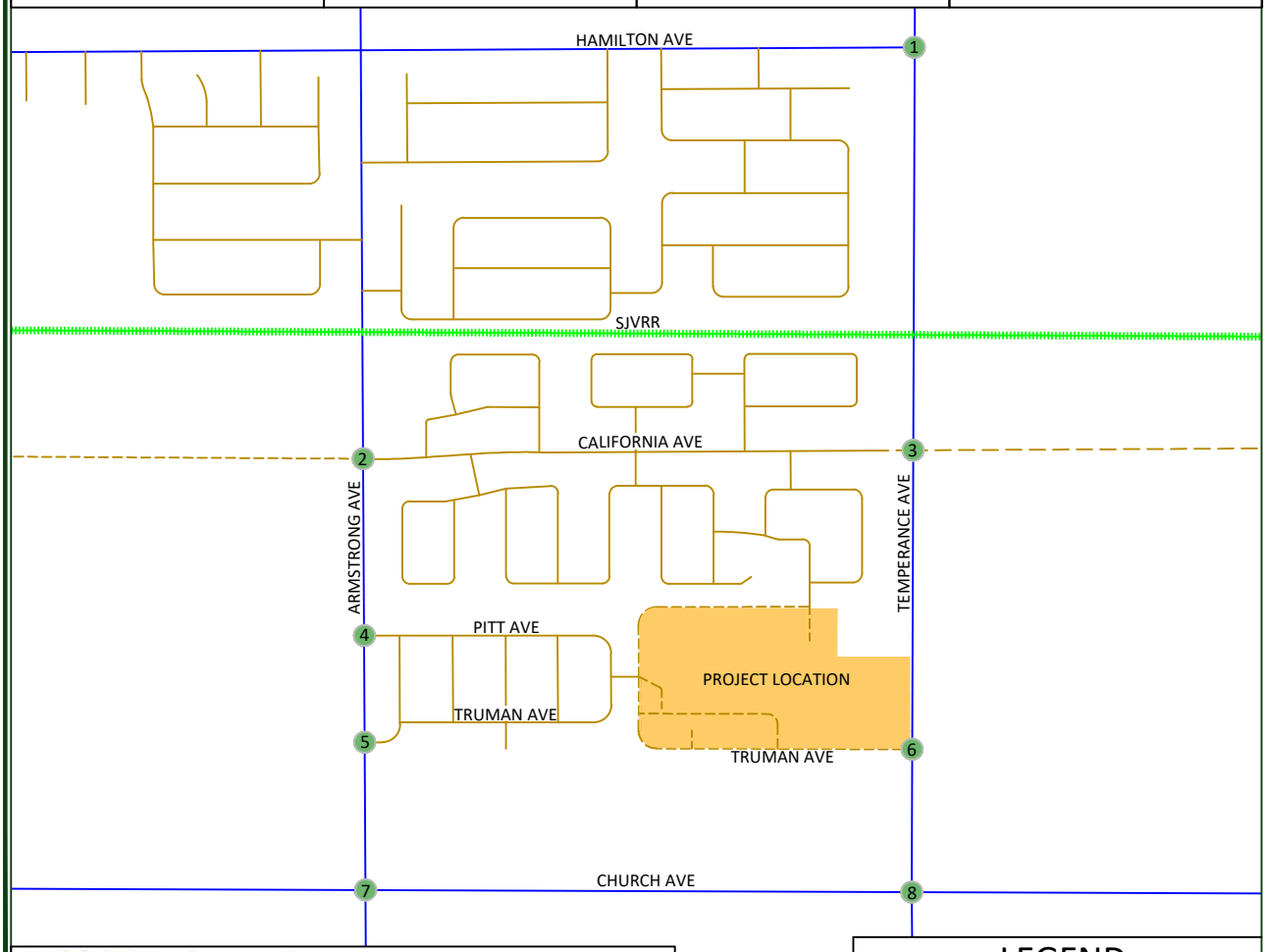
# SUSD Elementary School
# Existing plus Project - Traffic Volumes, Geometrics and Controls

Figure 6

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  |  |  |
| 59(121) 335(278) 1(0) Temperance Ave; Hamilton Avenue; 277(70) 133(30) 39(30) 263(329) | 162(101) 23(66) Armstrong Ave; 40(36) 41(12) 2(0) California Ave; 175(171) 35(38) | 15(66) 415(237) Temperance Ave; California Ave; 103(56) 100(12) 12(11) 197(266) | 143(73) 57(35) Armstrong Ave; 108(66) 14(3) Pitt Ave; 100(141) 4(7) |

| 5. Armstrong Ave & Truman Ave | 6. Temperance Ave & Truman Ave | 7. Armstrong Ave & Church Ave | 8. Temperance Ave & Church Ave |
|---|---|---|---|
|  |  |  |  |
| 154(69) 5(6) Armstrong Ave; 7(7) 34(8) Truman Ave; 92(140) 4(12) | 133(22) 382(227) Temperance Ave; Truman Ave; 86(3) 10(21) 209(277) | 42(28) 127(44) 14(8) Armstrong Ave; 10(22) 11(39) 14(0) Church Ave; 23(62) 42(35) 94(1) 81(6) 75(66) 14(2) | 19(35) 401(190) 29(3) Temperance Ave; 11(4) 1(6) 5(2) Church Ave; 28(21) 10(8) 36(12) 10(22) 179(255) 0(2) |





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## LEGEND

- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PEAK HOUR TRIPS
- (XX) = PM PEAK HOUR TRIPS
- = STOP SIGN

N

Not To Scale

# 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 Fresno County, City of Fresno and Caltrans staff were consulted throughout the preparation of this Report 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 Near Term Projects listed in Table V were approved, near approval, or in the pipeline within the proximity of the proposed Project.

The trip generation listed in Table V is that which is anticipated to be added to the roadway network 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 V, the total trip generation for the Near Term Projects is 102,312 daily trips, 8,307 AM peak hour trips and 9,817 PM peak hour trips. Figure 7 illustrates the location of the Near Term Projects and their combined trip assignment to the study intersections.

**Table V: Near Term Projects' Trip Generation**

| *Near Term Project ID* | *Near Term Project Name* | *Daily Trips* | *AM Peak Hour* | *PM Peak Hour* |
|---|---|---|---|---|
| A | TT 5434 (portion of)[1] | 1,114 | 87 | 117 |
| B | TT 5464 (portion of)[1] | 585 | 46 | 61 |
| C | TT 5498[1] | 755 | 59 | 79 |
| D | TT 5592 (portion of)[2] | 1,246 | 98 | 131 |
| E | TT 5638[1] | 4,295 | 337 | 450 |
| F | TT 5717 (portion of)[1] | 1,199 | 94 | 126 |
| G | TT 5913 (portion of)[3] | 302 | 24 | 32 |
| H | TT 6095 (portion of)[1] | 47 | 4 | 5 |
| I | TT 6130 (portion of)[4] | 94 | 7 | 10 |
| J | TT 6191 (portion of)[4] | 349 | 27 | 37 |
| K | TT 6201[4] | 2,426 | 190 | 254 |
| L | TT 6214[4] | 1,982 | 155 | 208 |
| M | TT 6219[4] | 1,208 | 95 | 127 |
| N | TT 6224[1] | 3,295 | 258 | 346 |
| O | TT 6235[4] | 1,152 | 90 | 121 |
| P | TT 6241[4] | 2,124 | 167 | 223 |
| Q | TT 6281[4] | 1,246 | 98 | 131 |
| R | TT 6285[4] | 1,709 | 134 | 179 |
| S | TT 6295[2] | 1,040 | 82 | 109 |
| T | TT 6298[4] | 1,048 | 82 | 110 |
| U | TT 6299[4] | 2,058 | 161 | 216 |
| V | 7-Eleven and Fuel Station[2] | 1,540 | 95 | 129 |
| W | Lennar Homes (Heirloom) (portion of)[1] | 1,029 | 81 | 108 |
| X | Fancher Creek (portion of)[5] | 55,741 | 2,923 | 5,277 |

**Table V: Near Term Projects' Trip Generation (Continued)**

| *Near Term Project ID* | *Near Term Project Name* | *Daily Trips* | *AM Peak Hour* | *PM Peak Hour* |
|---|---|---|---|---|
| Y | Neighborhood Shopping Center (portion of)[3] | 2,065 | 148 | 159 |
| Z | Sunnyside Market[3] | 1,023 | 38 | 54 |
| AA | Fowler-McKinley Elementary School[4] | 1,418 | 503 | 128 |
| AB | Fowler-Shields Mixed-Use Development (portion of)[1] | 2,625 | 89 | 250 |
| AC | Sanger Unified School District Educational Center[6] | 7,597 | 2,135 | 640 |
| **Total Near Term Project Trips** | | **102,312** | **8,307** | **9,817** |

Note: 1 = Trip Generation prepared by JLB Traffic Engineering, Inc. based on readily available information
2 = Trip Generation based on Peters Engineering Group Traffic Impact Analysis Report
3 = Trip Generation based on TJKM Transportation Consultants Traffic Impact Analysis Report
4 = Trip Generation based on JLB Traffic Engineering, Inc. Traffic Impact Analysis Report
5 = Trip Generation based on TPG Consulting, Inc. Traffic Impact Analysis Report
6 = Trip Generation based on Arch Beach Consulting Traffic Impact Analysis Report

## Traffic Signal Warrants

Warrant 3 was prepared for the unsignalized intersections under the Near Term plus Project Traffic Conditions scenario. These warrants are contained in Appendix K. Under this scenario, the study intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, and Temperance Avenue and Church Avenue are projected to satisfy Warrant 3 during both peak periods. Worthy of note is the intersection of Temperance Avenue and Truman Avenue and Armstrong Avenue and Church Avenue are projected to satisfy Warrant 3 during the AM peak period only. Based on the traffic signal warrants, operational analysis and engineering judgement, it is recommended that the city consider implementing traffic signal controls at the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue. Alternatively, it is not recommended that the city consider implementing traffic signal controls at the intersection of Temperance Avenue and Truman Avenue especially since this intersection is projected to operate at an acceptable LOS during both peak periods under stop sign control. 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.

## Roadway Network

The Near Term plus Project Traffic Conditions scenario assumes the same roadway geometrics and traffic controls as those assumed in the Existing plus Project Traffic Conditions scenario with one exception. For purposes of this analysis, it is anticipated that California Avenue will extend west of Armstrong Avenue as part of Near Term Project Tract 5638. Moreover, it is assumed that the future intersection of Armstrong Avenue and California Avenue is controlled by a two-way stop on California Avenue approaches. Figure 8 illustrates the assumed intersection geometrics and traffic controls for these intersections under this scenario.

## Results of Near Term plus Project Level of Service Analysis

The Near Term plus Project Traffic Conditions scenario assumes that California Avenue connects to Temperance Avenue and extends west of Armstrong Avenue. Figure 8 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 H. Table VI presents a summary of the Near Term plus Project peak hour LOS at the study intersections.

Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.

- Temperance Avenue / Hamilton Avenue
  - Open the southbound left-turn lane to allow southbound to northbound U-turns;
  - Modify the southbound left-through lane to a southbound through-lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / California Avenue
  - Signalize the intersection with protective left-turn phasing in all directions.
- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through-right lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through-right lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.

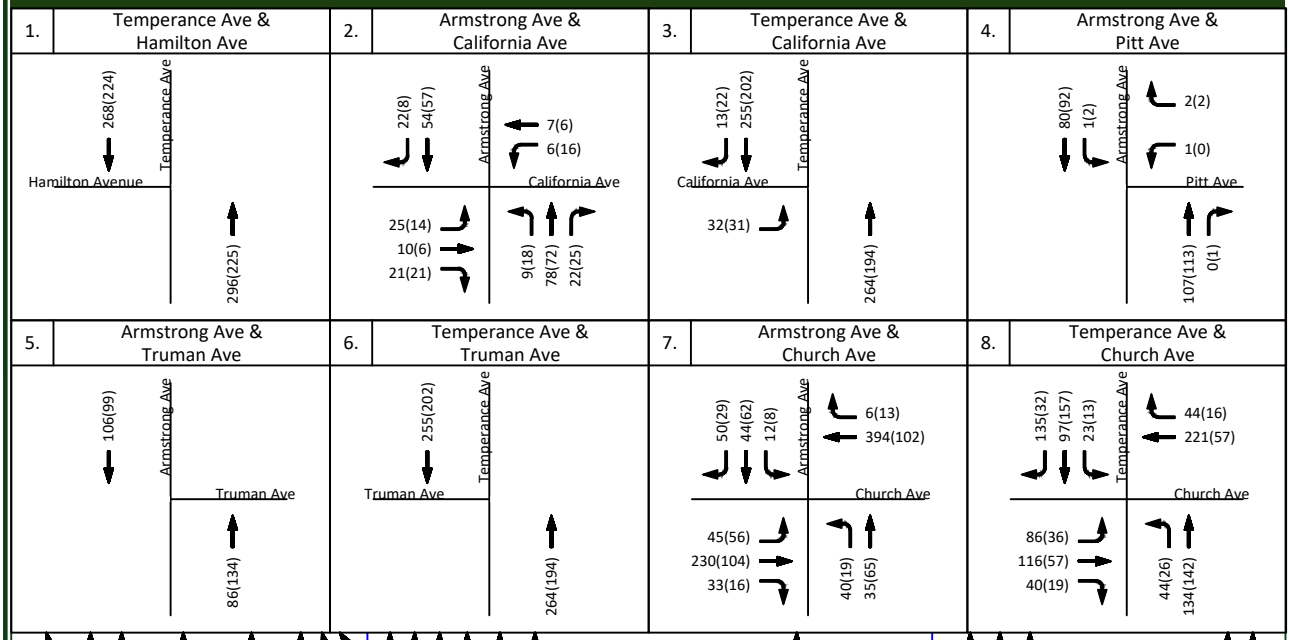
## Table VI: Near Term plus Project Intersection LOS Results

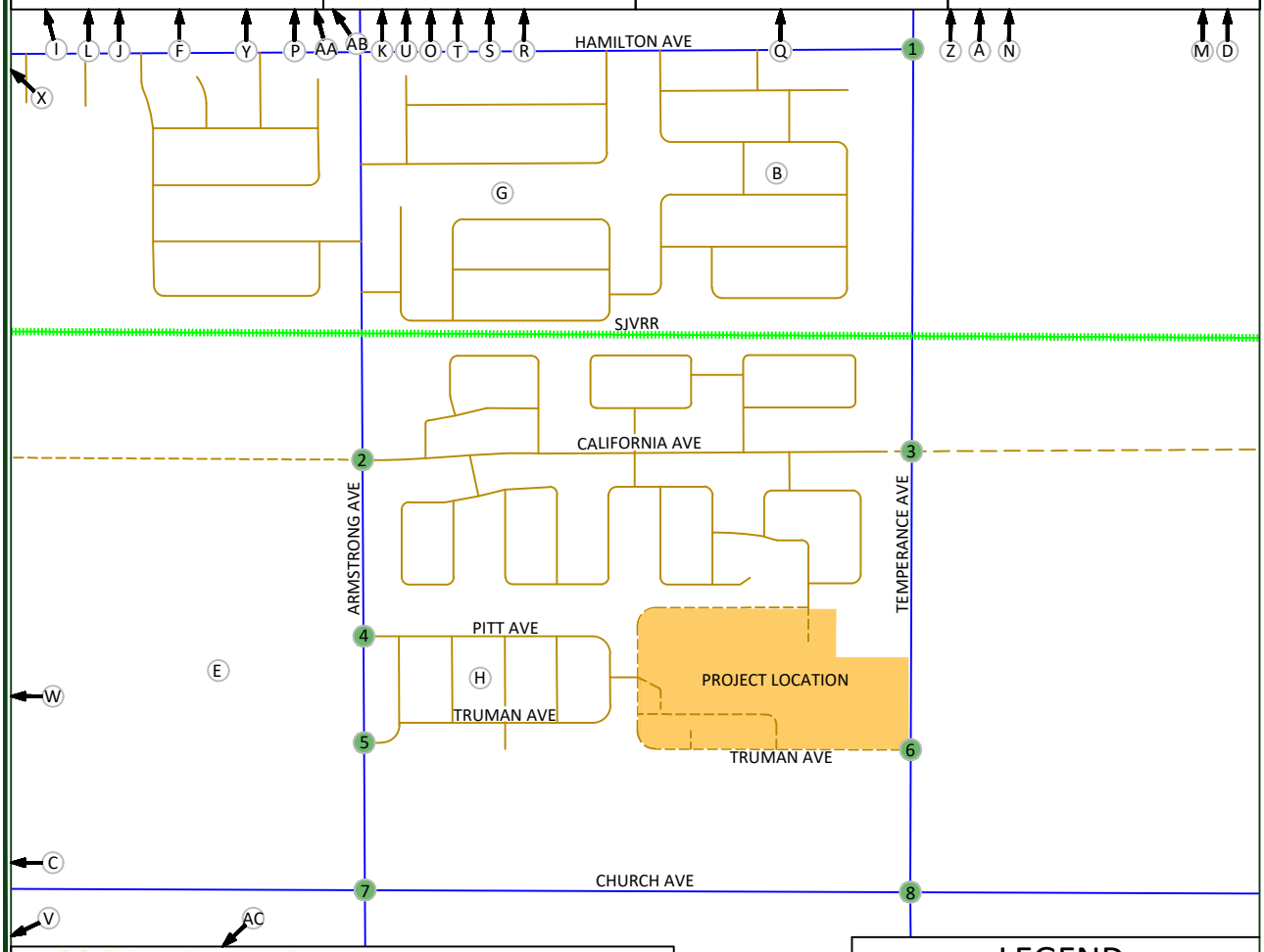
| ID | Intersection | Intersection Control | AM (7-9) Peak Hour | | PM (4-6) Peak Hour | |
|---|---|---|---|---|---|---|
| | | | Average Delay (sec/veh) | LOS | Average Delay (sec/veh) | LOS |
| 1 | Temperance Avenue / Hamilton Avenue | All-Way Stop | **>120.0** | **F** | **41.0** | **E** |
| | | Traffic Signal (Improved) | 22.4 | C | 9.7 | A |
| 2 | Armstrong Avenue / California Avenue | One-Way Stop | 19.1 | C | 13.4 | B |
| 3 | Temperance Avenue / California Avenue | One-Way Stop | **73.7** | **F** | 25.3 | D |
| | | Traffic Signal (Improved) | 12.0 | B | 6.2 | A |
| 4 | Armstrong Avenue / Pitt Avenue | One-Way Stop | 12.4 | B | 9.7 | A |
| 5 | Armstrong Avenue / Truman Avenue | One-Way Stop | 16.8 | C | 11.6 | B |
| 6 | Temperance Avenue / Truman Avenue | One-Way Stop | 16.4 | C | 11.2 | B |
| 7 | Armstrong Avenue / Church Avenue | All-Way Stop | **>120.0** | **F** | 10.6 | B |
| | | Traffic Signal (Improved) | 53.0 | D | 42.5 | D |
| 8 | Temperance Avenue / Church Avenue | Two-Way Stop | **>120.0** | **F** | **71.3** | **F** |
| | | Traffic Signal (Improved) | 48.2 | D | 34.8 | 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.

# SUSD Elementary School
# Near Term Project Trips' Assignment

Figure 7





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## LEGEND

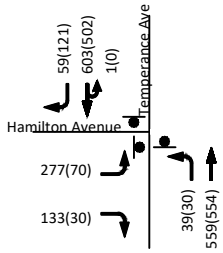
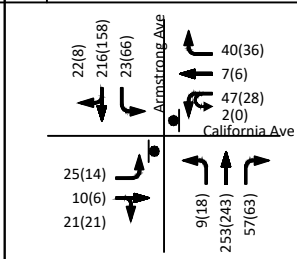
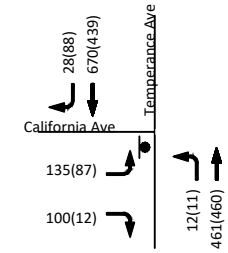
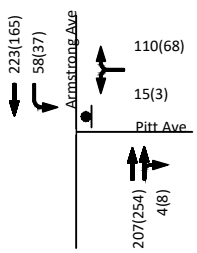
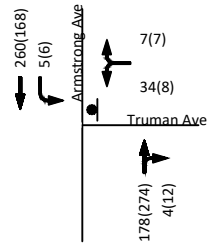
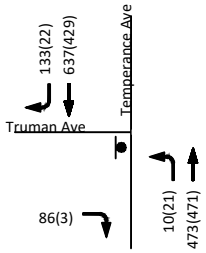
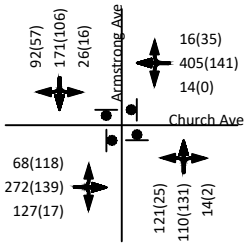
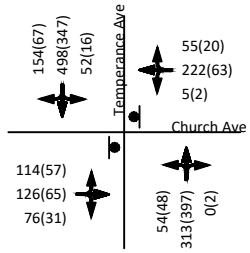
- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM NEAR TERM TRIPS
- (XX) = PM NEAR TERM TRIPS
- (#) = NEAR TERM PROJECT LOCATION

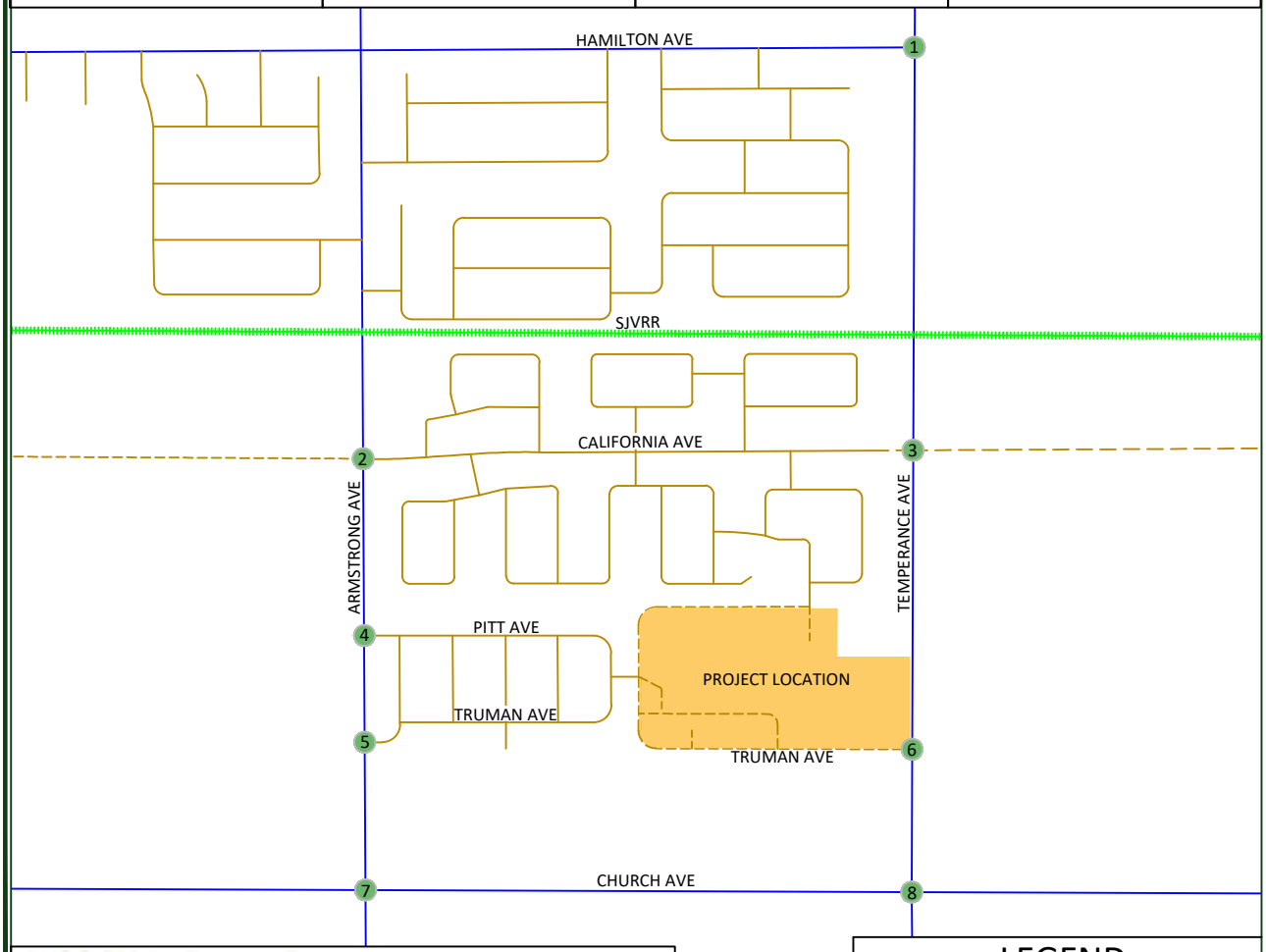
N

Not To Scale

# SUSD Elementary School
# Near Term plus Project - Traffic Volumes, Geometrics and Controls

Figure 8

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  |  |  |
| **5. Armstrong Ave & Truman Ave** | **6. Temperance Ave & Truman Ave** | **7. Armstrong Ave & Church Ave** | **8. Temperance Ave & Church Ave** |
|  |  |  |  |





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## LEGEND

- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PEAK HOUR TRIPS
- (XX) = PM PEAK HOUR TRIPS
- = STOP SIGN

N

Not To Scale

# Cumulative Year 2040 No Project Traffic Conditions

## Traffic Signal Warrants

Warrant 3 was prepared for the unsignalized intersections under the Cumulative Year 2040 No Project Traffic Conditions scenario. These warrants are contained in Appendix K. Under this scenario, the study intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue are projected to satisfy Warrant 3 during both peak periods. Based on the traffic signal warrants, operational analysis and engineering judgement, it is recommended that the city consider implementing traffic signal controls at these intersections.

## Roadway Network

The Cumulative Year 2040 No Project Traffic Conditions scenario assumes the same roadway geometrics and traffic controls as those assumed in the Near Term plus Project Traffic Conditions scenario with a few exceptions. For purposes of this analysis, it is assumed that California Avenue is built as a two-lane divided collector between Clovis Avenue and Temperance Avenue and a two-lane collector divided by a two-way left-turn lane between Temperance Avenue and Highland Avenue. Moreover, it is assumed that the intersection of Temperance Avenue and California Avenue is controlled by a two-way stop on California Avenue approaches. Figure 9 illustrates the assumed intersection geometrics and traffic controls for these intersections under this scenario.

## Results of Cumulative Year 2040 No Project Level of Service Analysis

The Cumulative Year 2040 No Project Traffic Conditions scenario assumes that California Avenue exists between Clovis Avenue and Highland Avenue. 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 I. Table VII presents a summary of the Cumulative Year 2040 No Project peak hour LOS at the study intersections.

Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.

- Temperance Avenue / Hamilton Avenue
  - Open the southbound left-turn lane to allow southbound to northbound U-turns;
  - Modify the southbound left-through lane to a southbound through lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / California Avenue
  - Add a second southbound through lane with receiving lane south of California Avenue; and
  - Signalize the intersection with protective left-turn phasing in all directions.

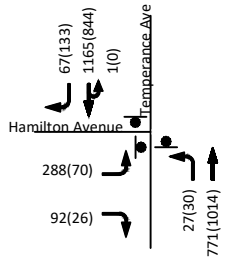
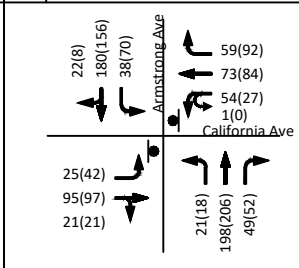
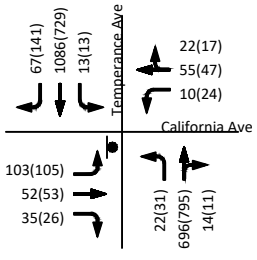
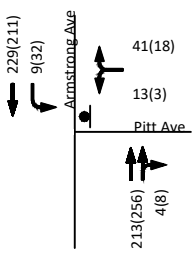
- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through lane;
  - Add a westbound right-turn lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound through lane with receiving lane south of Church Avenue;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.

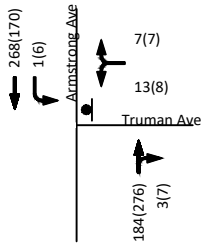
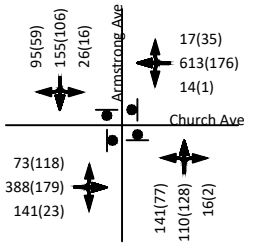
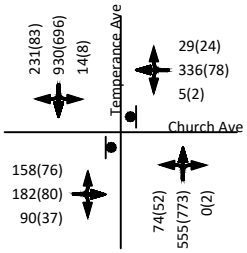
## Table VII: Cumulative Year 2040 No Project Intersection LOS Results

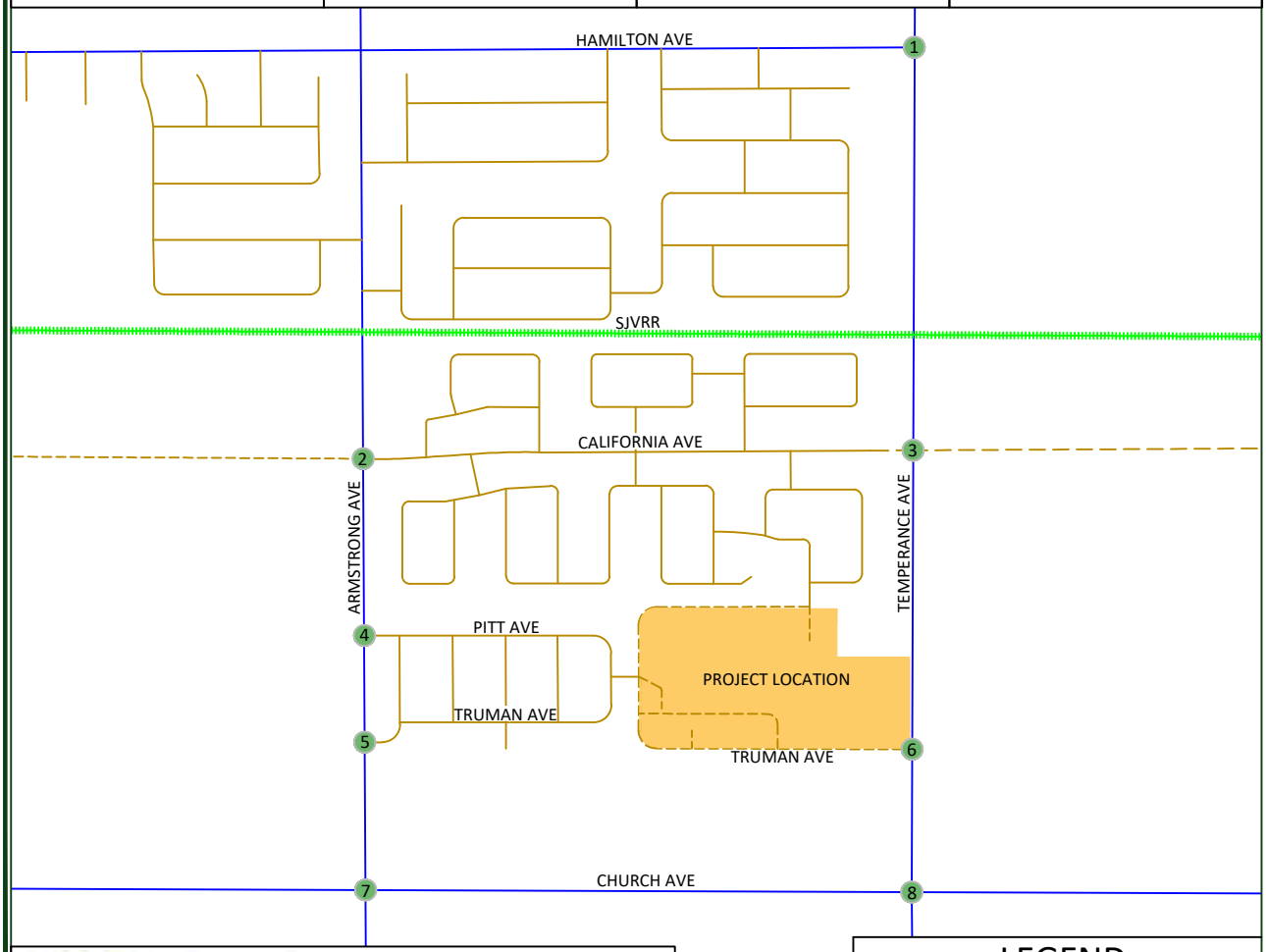
| *ID* | *Intersection* | *Intersection Control* | *AM (7-9) Peak Hour* | | *PM (4-6) Peak Hour* | |
|---|---|---|---|---|---|---|
| | | | *Average Delay (sec/veh)* | *LOS* | *Average Delay (sec/veh)* | *LOS* |
| 1 | Temperance Avenue / Hamilton Avenue | All-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 43.7 | D | 11.5 | B |
| 2 | Armstrong Avenue / California Avenue | One-Way Stop | 17.1 | C | 20.2 | C |
| 3 | Temperance Avenue / California Avenue | One-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 16.6 | B | 16.1 | B |
| 4 | Armstrong Avenue / Pitt Avenue | One-Way Stop | 9.8 | A | 9.6 | A |
| 5 | Armstrong Avenue / Truman Avenue | One-Way Stop | 11.2 | B | 11.1 | B |
| 6 | Temperance Avenue / Truman Avenue | Does Not Exist | N/A | N/A | N/A | N/A |
| 7 | Armstrong Avenue / Church Avenue | All-Way Stop | **>120.0** | **F** | 12.4 | B |
| | | Traffic Signal (Improved) | 49.7 | D | 31.6 | D |
| 8 | Temperance Avenue / Church Avenue | Two-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 39.0 | D | 46.4 | C |

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.

# SUSD Elementary School — Figure 9
## Cumulative Year 2040 No Project - Traffic Volumes, Geometrics and Controls

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  |  |  |

| 5. Armstrong Ave & Truman Ave | 6. Temperance Ave & Truman Ave | 7. Armstrong Ave & Church Ave | 8. Temperance Ave & Church Ave |
|---|---|---|---|
|  | DOES NOT EXIST |  |  |

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### LEGEND

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- = FUTURE ROADWAY
- XX = AM PEAK HOUR TRIPS
- (XX) = PM PEAK HOUR TRIPS
- = STOP SIGN

N

Not To Scale

# Cumulative Year 2040 plus Project Traffic Conditions

## Traffic Signal Warrants

Warrant 3 was prepared for the unsignalized intersections under the Cumulative Year 2040 plus Project Traffic Conditions scenario. These warrants are contained in Appendix K. Under this scenario, the study intersections of Temperance Avenue and Hamilton Avenue, Armstrong Avenue and California Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue are projected to satisfy Warrant 3 during both peak periods. Worthy of note is the intersection of Temperance Avenue and Truman Avenue is projected to satisfy Warrant 3 during the AM peak period only. Based on the traffic signal warrants, operational analysis and engineering judgement, it is recommended that the city consider implementing traffic signal controls at the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue. Alternatively, it is not recommended that the city consider implementing traffic signal controls at the intersection of Armstrong Avenue and California Avenue especially since this intersection is projected to operate at an acceptable LOS during both peak periods under stop sign control. Similarly, it is not recommended that the intersection of Temperance Avenue and Truman Avenue be considered for implementation of traffic signal controls. 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 these intersections.

## Results of Cumulative Year 2040 plus Project Level of Service Analysis

The Cumulative Year 2040 plus Project Traffic Conditions scenario assumes the same roadway geometrics and traffic controls as those assumed in the Cumulative Year 2040 No Project Traffic Conditions scenario. Considering the potential changes in the existing roadway network, it is projected that travel patterns and volumes may differ from what is anticipated for the immediate Project buildout. Therefore, Figure 10 illustrates the Project Only Trips to the study intersections and Project driveways under cumulative year 2040. Figure 11 illustrates the assumed intersection geometrics and traffic controls for the study intersections under this scenario. LOS worksheets for the Cumulative Year 2040 plus Project Traffic Conditions scenario are provided in Appendix J. Table VIII presents a summary of the Cumulative Year 2040 plus Project peak hour LOS at the study intersections.

Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Temperance Avenue and Truman Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.

- Temperance Avenue / Hamilton Avenue
  - Open the southbound left-turn lane to allow southbound to northbound U-turns;
  - Modify the southbound left-through lane to a southbound through lane;
  - Add a southbound through lane with receiving lane south of Hamilton Avenue;
  - Modify the southbound trap right-turn lane to a typical right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / California Avenue
  - Add a second southbound through lane with a receiving lane south of California Avenue; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Truman Avenue
  - Modify the southbound right-turn lane to a through-right lane with a receiving lane south of Truman Avenue.
- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through lane;
  - Add a westbound right-turn lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound through lane with receiving lane south of Church Avenue;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.

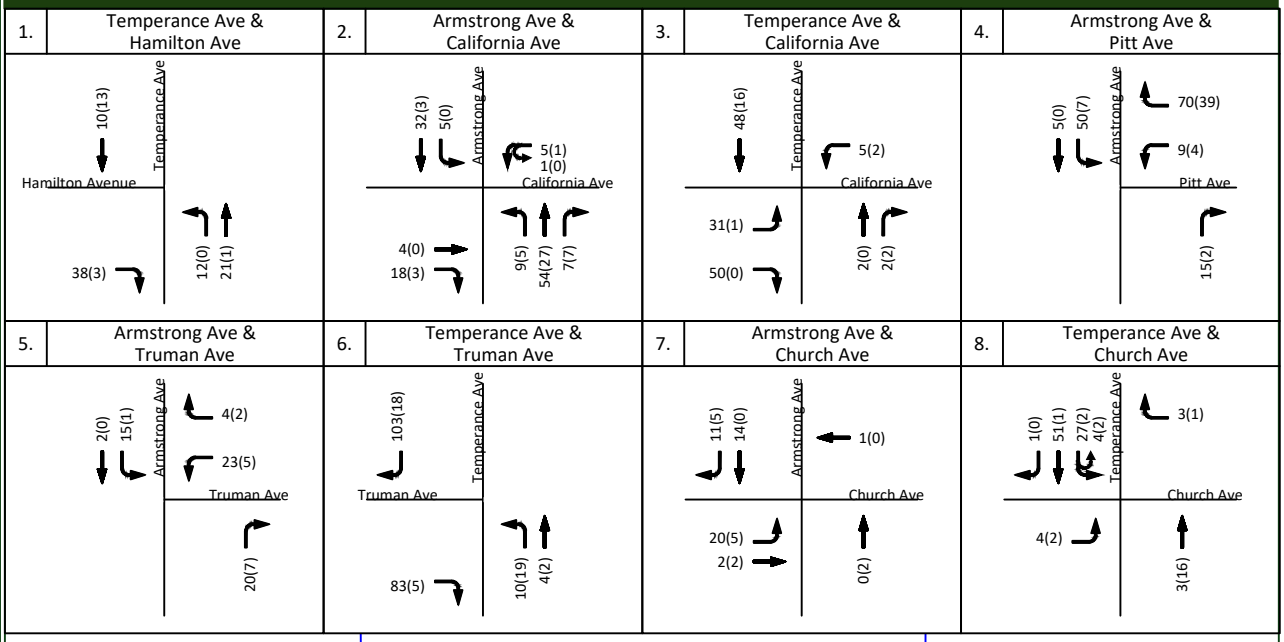
## Table VIII: Cumulative Year 2040 plus Project Intersection LOS Results

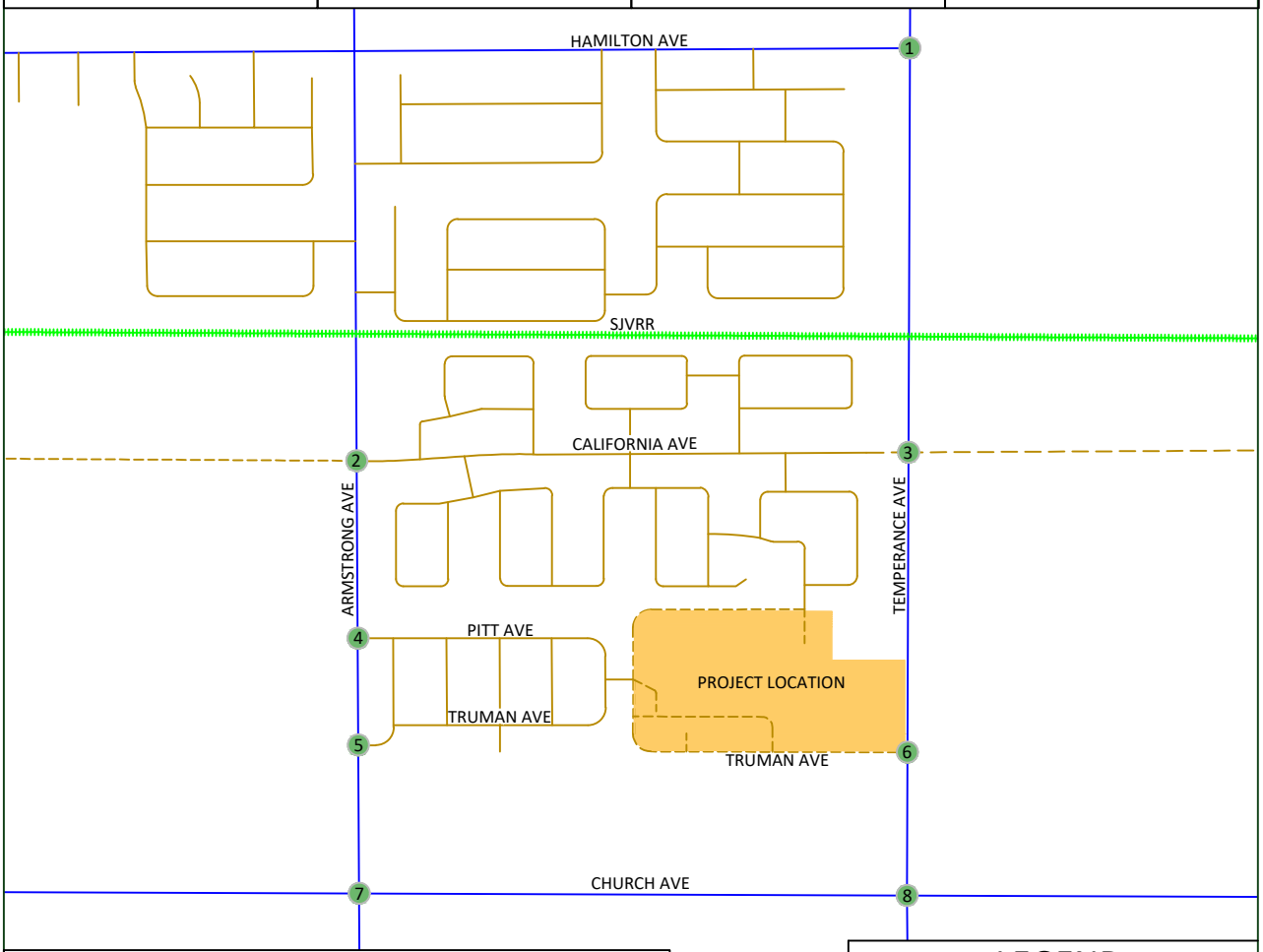
| *ID* | *Intersection* | *Intersection Control* | *AM (7-9) Peak Hour* | | *PM (4-6) Peak Hour* | |
|---|---|---|---|---|---|---|
| | | | *Average Delay (sec/veh)* | *LOS* | *Average Delay (sec/veh)* | *LOS* |
| 1 | Temperance Avenue / Hamilton Avenue | All-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 20.5 | C | 9.9 | A |
| 2 | Armstrong Avenue / California Avenue | One-Way Stop | 20.5 | C | 21.7 | C |
| 3 | Temperance Avenue / California Avenue | One-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 43.6 | D | 16.6 | B |
| 4 | Armstrong Avenue / Pitt Avenue | One-Way Stop | 10.5 | B | 9.8 | A |
| 5 | Armstrong Avenue / Truman Avenue | One-Way Stop | 12.4 | B | 11.4 | B |
| 6 | Temperance Avenue / Truman Avenue | One-Way Stop | **59.2** | **F** | 16.0 | C |
| | | One-Way Stop (Improved) | 20.4 | C | 11.9 | B |
| 7 | Armstrong Avenue / Church Avenue | All-Way Stop | **>120.0** | **F** | 12.7 | B |
| | | Traffic Signal (Improved) | 38.5 | D | 37.4 | D |
| 8 | Temperance Avenue / Church Avenue | Two-Way Stop | **>120.0** | **F** | **>120.0** | **F** |
| | | Traffic Signal (Improved) | 45.9 | D | 28.8 | C |

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.

# SUSD Elementary School
# Project Only Trips (2040)

Figure 10





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## LEGEND

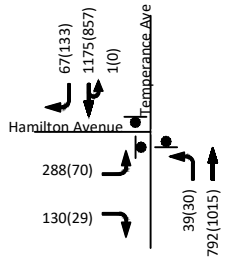
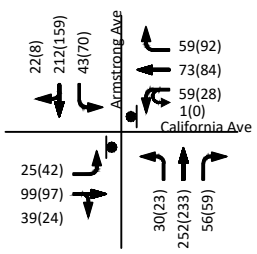
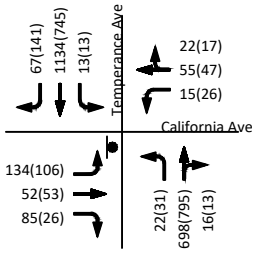
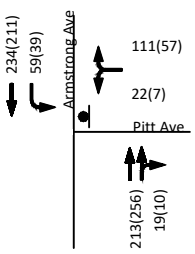
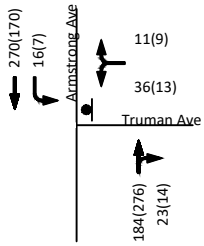
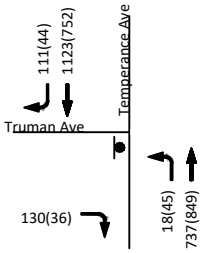
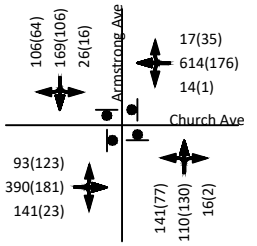
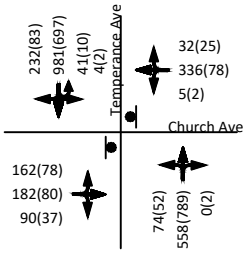
- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PROJECT ONLY TRIPS
- (XX) = PM PROJECT ONLY TRIPS

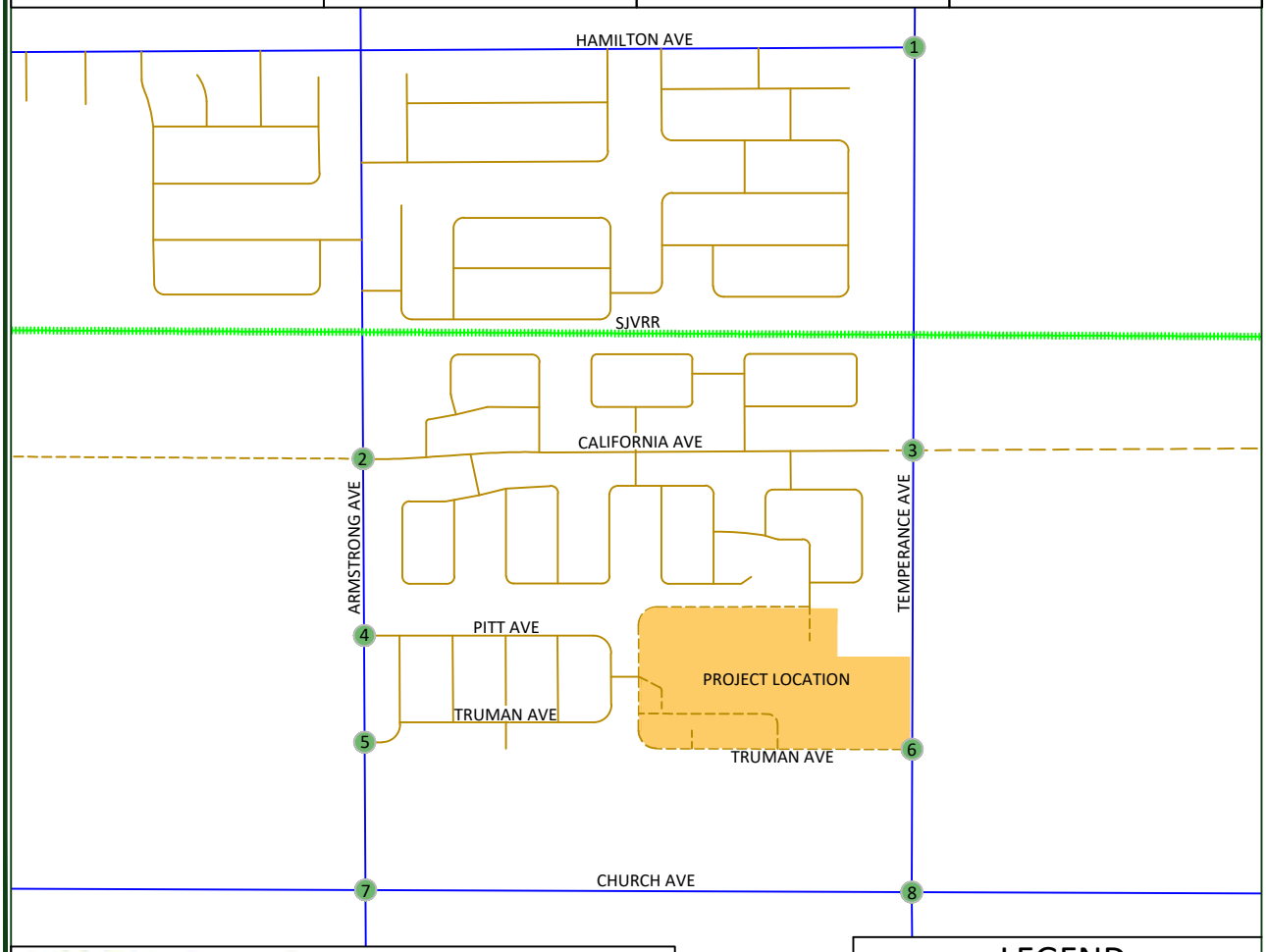
N

Not To Scale

# SUSD Elementary School
# Cumulative Year 2040 plus Project - Traffic Volumes, Geometrics and Controls

Figure 11

| 1. Temperance Ave & Hamilton Ave | 2. Armstrong Ave & California Ave | 3. Temperance Ave & California Ave | 4. Armstrong Ave & Pitt Ave |
|---|---|---|---|
|  |  |  |  |
| **5. Armstrong Ave & Truman Ave** | **6. Temperance Ave & Truman Ave** | **7. Armstrong Ave & Church Ave** | **8. Temperance Ave & Church Ave** |
|  |  |  |  |

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## LEGEND

- # = STUDY INTERSECTION
- = FUTURE ROADWAY
- XX = AM PEAK HOUR TRIPS
- (XX) = PM PEAK HOUR TRIPS
- = STOP SIGN

N

Not To Scale

# Queuing Analysis

Table IX 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 SimTraffic 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" (*Synchro Studio 10 User Guide* 2017). The queues shown on Table IX are the 95th percentile queue lengths for the respective lane movements.

The CA HDM provides guidance for determining deceleration lengths for the left-turn and right-turn lanes based on design speeds. According to the CA HDM, tapers for right-turn lanes are "usually unnecessary since main line traffic need not be shifted laterally to provide space for the right-turn lane. If, in some rare instances, a lateral shift were needed, the approach taper would use the same formula as for a left-turn lane" (Caltrans 2019). Therefore, a bay taper length pursuant to the CA HDM would need to be added, as necessary, to the recommended storage lengths presented in Table IX.

The storage capacity for the Cumulative Year 2040 plus Project Traffic Conditions shall be based on the SimTraffic output files and engineering judgement. The values in bold presented in Table IX are the projected queue lengths that will likely need to be accommodated by the Cumulative Year 2040 plus Project Traffic Conditions scenario. At the remaining approaches of the study intersections, the existing storage capacity will be sufficient to accommodate the maximum queue.

## Table IX: 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 | Temperance Avenue / Hamilton Avenue | EB Left | 250 | 103 | 46 | 106 | 43 | 281 | 98 | 296 | 94 | **308** | 84 |
| | | EB Right | >500 | 35 | 21 | 51 | 25 | 192 | 35 | 203 | 37 | 117 | 29 |
| | | NB Left | 200 | 43 | 42 | 53 | 46 | 66 | 44 | 123 | 68 | 61 | 63 |
| | | NB Thru | >500 | 67 | 77 | 92 | 76 | 249 | 173 | 349 | 390 | 414 | 505 |
| | | SB Left | * | * | * | * | * | 0 | 0 | 0 | 0 | 9 | 0 |
| | | SB Left-Thru | >500 | 97 | 52 | 146 | 71 | * | * | * | * | * | * |
| | | SB Thru | * | * | * | * | * | 308 | 175 | 696 | 369 | 327 | 178 |
| | | SB Thru | * | * | * | * | * | * | * | * | * | 317 | 185 |
| | | SB Right | >500 | 49 | 61 | 50 | 51 | 37 | 41 | 41 | 43 | 134 | 48 |

Note: * = Does not exist or is not projected to exist

## Table IX: Queuing Analysis (continued)

| 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 |
| 2 | Armstrong Avenue / Church Avenue | EB Left | * | * | * | * | * | 53 | 35 | 40 | 52 | 44 | 60 |
| | | EB Thru-Right | * | * | * | * | * | 41 | 41 | 70 | 72 | 85 | 70 |
| | | WB Left | 250 | 45 | 42 | 46 | 27 | 45 | 48 | 55 | 46 | 56 | 47 |
| | | WB Thru | * | * | * | * | * | 32 | 28 | 58 | 62 | 57 | 57 |
| | | WB Right | >500 | 46 | 40 | 59 | 36 | 43 | 35 | 41 | 53 | 44 | 48 |
| | | NB Left | * | * | * | * | * | 9 | 14 | 12 | 6 | 19 | 7 |
| | | NB Thru | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| | | NB Right | >500 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 11 | 0 | 0 |
| | | SB Left | 230 | 0 | 51 | 13 | 44 | 16 | 26 | 18 | 32 | 20 | 30 |
| | | SB Thru | >500 | 0 | 0 | 0 | 0 | * | * | * | * | * | * |
| | | SB Thru-Right | * | * | * | * | * | 0 | 0 | 7 | 0 | 0 | 0 |
| 3 | Temperance Avenue / California Avenue | EB Left | * | * | * | 69 | 41 | 146 | 100 | 146 | 137 | 235 | 127 |
| | | EB Thru | * | * | * | * | * | * | * | 36 | 49 | 57 | 70 |
| | | EB Right | * | * | * | 48 | 18 | 62 | 16 | 34 | 26 | 69 | 23 |
| | | WB Left | * | * | * | * | * | * | * | 28 | 54 | 40 | 59 |
| | | WB Thru-Right | * | * | * | * | * | * | * | 94 | 91 | 86 | 89 |
| | | NB Left | * | * | * | 21 | 19 | 29 | 38 | 136 | 39 | 191 | 237 |
| | | NB Thru | * | * | * | 0 | 0 | 144 | 126 | * | * | * | * |
| | | NB Thru-Right | * | * | * | * | * | * | * | 298 | 641 | 513 | 551 |
| | | SB Left | * | * | * | 0 | 0 | 0 | 0 | 18 | 32 | 37 | 42 |
| | | SB Thru | * | * | * | 0 | 0 | 204 | 169 | 222 | 165 | 408 | 251 |
| | | SB Thru | * | * | * | * | * | * | * | 285 | 206 | 412 | 286 |
| | | SB Right | * | * | * | 0 | 0 | 23 | 29 | 43 | 55 | 133 | 54 |
| 4 | Armstrong Avenue / Pitt Avenue | WB Left-Right | >500 | 44 | 35 | 61 | 49 | 59 | 55 | 47 | 42 | 70 | 66 |
| | | NB Thru | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | NB Thru-Right | >300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | SB Left-Thru | >500 | 9 | 9 | 31 | 23 | 26 | 24 | 8 | 28 | 35 | 49 |
| 5 | Armstrong Avenue / Truman Avenue | WB Left-Right | >500 | 40 | 33 | 53 | 33 | 52 | 37 | 40 | 39 | 55 | 39 |
| | | NB Thru-Right | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | SB Left-Thru | >500 | 0 | 13 | 0 | 0 | 9 | 12 | 9 | 16 | 27 | 8 |

Note: * = Does not exist or is not projected to exist

## Table IX: Queuing Analysis (continued)

| 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 |
| 6 | Temperance Avenue / Truman Avenue | EB Right | * | * | * | 57 | 12 | 75 | 10 | * | * | 118 | 48 |
| | | NB Left | * | * | * | 19 | 13 | 27 | 27 | * | * | 32 | 41 |
| | | NB Thru | * | * | * | 0 | 0 | 0 | 0 | * | * | 0 | 0 |
| | | SB Thru | * | * | * | 0 | 0 | 0 | 0 | * | * | 0 | 10 |
| | | SB Thru-Right | * | * | * | * | * | * | * | * | * | 16 | 0 |
| | | SB Right | * | * | * | 7 | 0 | 11 | 0 | * | * | * | * |
| 7 | Armstrong Avenue / Church Avenue | EB Left-Thru-Right | >500 | 53 | 43 | 64 | 44 | * | * | * | * | * | * |
| | | EB Left | * | * | * | * | * | 104 | 130 | 104 | 144 | 160 | 105 |
| | | EB Thru | * | * | * | * | * | 125 | 55 | 183 | 93 | 175 | 83 |
| | | EB Right | * | * | * | * | * | 63 | 11 | 58 | 16 | 65 | 13 |
| | | WB Left-Thru-Right | >500 | 42 | 40 | 41 | 41 | * | * | * | * | * | * |
| | | WB Left | * | * | * | * | * | 47 | 0 | 34 | 8 | 33 | 8 |
| | | WB Thru-Right | * | * | * | * | * | 294 | 76 | 313 | 157 | 292 | 95 |
| | | NB Left-Thru-Right | >500 | 64 | 40 | 56 | 40 | * | * | * | * | * | * |
| | | NB Left | * | * | * | * | * | 135 | 48 | 164 | 86 | 210 | 78 |
| | | NB Thru-Right | * | * | * | * | * | 127 | 109 | 128 | 93 | 141 | 104 |
| | | SB Left-Thru-Right | >500 | 74 | 44 | 74 | 45 | * | * | * | * | * | * |
| | | SB Left | * | * | * | * | * | 56 | 29 | 45 | 40 | 56 | 46 |
| | | SB Thru | * | * | * | * | * | 151 | 125 | 148 | 106 | 176 | 103 |
| | | SB Right | * | * | * | * | * | 64 | 42 | 75 | 59 | **96** | 50 |

Note: * = Does not exist or is not projected to exist

## Table IX: Queuing Analysis (continued)

| 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 |
| 8 | Temperance Avenue / Church Avenue | EB Left-Thru-Right | >500 | 56 | 40 | 52 | 41 | * | * | * | * | * | * |
| | | EB Left | * | * | * | * | * | 174 | 73 | 147 | 77 | 196 | 104 |
| | | EB Thru | * | * | * | * | * | * | * | 118 | 95 | 157 | 70 |
| | | EB Thru-Right | * | * | * | * | * | 193 | 88 | * | * | * | * |
| | | EB Right | * | * | * | * | * | * | * | 59 | 43 | 52 | 36 |
| | | WB Left-Thru-Right | >500 | 25 | 28 | 32 | 30 | * | * | * | * | * | * |
| | | WB Left | * | * | * | * | * | 23 | 11 | 0 | 0 | 18 | 10 |
| | | WB Thru | * | * | * | * | * | * | * | 325 | 106 | 413 | 93 |
| | | WB Thru-Right | * | * | * | * | * | 357 | 95 | * | * | * | * |
| | | WB Right | * | * | * | * | * | * | * | 48 | 45 | 138 | 53 |
| | | NB Left-Thru-Right | >500 | 15 | 28 | 26 | 19 | * | * | * | * | * | * |
| | | NB Left | * | * | * | * | * | 109 | 64 | 83 | 96 | 172 | 71 |
| | | NB Thru-Right | * | * | * | * | * | 226 | 175 | 291 | 257 | 347 | 270 |
| | | SB Left-Thru-Right | >500 | 0 | 0 | 24 | 0 | * | * | * | * | * | * |
| | | SB Left | * | * | * | * | * | 156 | 34 | 28 | 36 | 74 | 26 |
| | | SB Thru | * | * | * | * | * | * | * | 321 | 185 | 351 | 162 |
| | | SB Thru | * | * | * | * | * | * | * | 302 | 204 | 363 | 165 |
| | | SB Thru-Right | * | * | * | * | * | 366 | 258 | * | * | * | * |
| | | SB Right | * | * | * | * | * | * | * | 177 | 43 | **224** | 43 |

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 X. 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 (2040) and Cumulative Year 2040 plus Project volumes. Figure 2 illustrates the Existing traffic volumes, Figure 10 illustrates the Project Only Trips (2040), and Figure 11 illustrates the Cumulative Year 2040 plus Project traffic volumes. Since the critical peak period for the study facilities was determined to be during the AM peak, the AM 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 X 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 SUSD work with the City of Fresno to develop the estimated construction cost(s).

**Table X: Project's Fair Share of Future Roadway Improvements**

| *ID* | *Intersection* | *Existing Traffic Volumes (AM Peak)* | *Cumulative Year 2040 plus Project Traffic Volumes (AM Peak)* | *2040 Project Only Trips (AM Peak)* | *Project's Fair Share (%)* |
|---|---|---|---|---|---|
| 1 | Temperance Avenue / Hamilton Avenue | 996 | 2,492 | 81 | 5.4 |
| 3 | Temperance Avenue / California Avenue | 544 | 2,313 | 138 | 7.8 |
| 6 | Temperance Avenue / Truman Avenue | 544 | 2,119 | 200 | 12.7 |
| 7 | Armstrong Avenue / Church Avenue | 569 | 1,837 | 48 | 3.8 |
| 8 | Temperance Avenue / Church Avenue | 586 | 2,697 | 93 | 4.4 |

Note: Project's Fair Share (%) = [((Project Only Trips (2040)) / (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*

- Based on a review of the collision reports during the most recent five-year period, a total of 30 collisions were reported within the influence zone of the study intersections. The intersection of Armstrong Avenue and Church Avenue has experienced an average of two broadside collisions per year, while the intersection of Temperance Avenue and Church Avenue has experienced approximately two broadside collisions per year since 2018. However, between July 1, 2019 and June 30, 2020 the intersection of Temperance Avenue and Church Avenue experienced a total of five collisions that can be correctable by the implementation of all-way stop traffic controls or improve corner sight distance.
- Considering the inherent factors of the collisions at the intersection of Armstrong Avenue and Church Avenue and that the traffic control at this location was modified from two-way stop to all-way stop control in September 2019, further changes to the existing traffic controls is not recommended for this intersection.
- Considering the inherent factors of the collisions at the intersection of Temperance Avenue and Church Avenue, JLB recommends that Fresno County conduct a corner sight distance evaluation pursuant to Chapter 400 of the latest edition of the California Highway Design Manual (CA HDM). If the existing available corner sight distance does not satisfy current standards, then Fresno County can determine if and how to accommodate the minimum corner sight distance requirement or consider implementing an all-way stop control in order to improve traffic safety.
- At present, all study intersections operate at an acceptable LOS during both peak periods.

## *Existing plus Project Traffic Conditions*

- The latest Project Site Plan integrates recommendations to a) add a secondary access point to the parking lot located along the north side of Truman Avenue and b) modify the parent drop-off exit to add a dedicated left-turn lane and right-turn lane and redesign the exit to encourage traffic toward Temperance Avenue as opposed to the neighborhood streets adjacent to the Project site.
- 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.
- At build-out, the Project is estimated to generate a maximum of 1,323 daily trips, 469 AM peak hour trips and 119 PM peak hour trips.
- It is recommended that the Project implement Class I and Class II Bikeways along its frontage to Temperance Avenue consistent with the *Fresno ATP*.
- It is recommended that the Project implement pedestrian sidewalks and Class I Bike Paths consistent with the Fresno *ATP* within and adjacent to the Project site. Adjacent to the Project site, it is recommended that the Project implement pedestrian sidewalks along future portions of Truman Avenue. Moreover, it is recommended that the Project implement a Class I Bike Path along its frontage to Temperance Avenue.

- At present, there are no FAX transit routes that operate adjacent to or in the vicinity of the Project.
- FCRTA provides transit services for those communities not served by FAX, Stageline or Round Up. Orange Cove Inter-City Transit provides scheduled round trip inter-city service through Orange Cove, Reedley, Parlier, Sanger, and the Fresno-Clovis Metropolitan Area Monday through Friday.
- At present, the average VMT to existing schools is 3.4 miles (round-trip). Upon completion of the Project, the average VMT is projected to be 2.4 miles (round-trip). Considering the Project is located in an area surrounded by residential land uses with adequate walking and bicycle facilities, it is anticipated that a majority of children will walk and bike to the Project site further reducing the Project's transportation VMT impact. Therefore, the Project is presumed to create a less than significant impact.
- In order to promote alternative modes of transportation to and from the Project site and improve student safety, it is recommended that SUSD work with the City of Fresno 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 Fresno, 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 Fresno County, City of Fresno and Caltrans staff were consulted throughout the preparation of this Report regarding Near Term Projects that could potentially impact the study intersections. JLB staff conducted a reconnaissance of the surrounding area and confirmed the Near Term Projects were approved, near approval, or in the pipeline within the proximity of the proposed Project.
- The total trip generation for the Near Term Projects is 102,312 daily trips, 8,307 AM peak hour trips and 9,817 PM peak hour trips.
- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.
  - Temperance Avenue / Hamilton Avenue
    - Open the southbound left-turn lane to allow southbound to northbound U-turns;
    - Modify the southbound left-through lane to a southbound through-lane; and
    - Signalize the intersection with protective left-turn phasing in all directions.
  - Temperance Avenue / California Avenue
    - Signalize the intersection with protective left-turn phasing in all directions.

- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through-right lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through-right lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.

### *Cumulative Year 2040 No Project Traffic Conditions*

- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.
  - Temperance Avenue / Hamilton Avenue
    - Open the southbound left-turn lane to allow southbound to northbound U-turns;
    - Modify the southbound left-through lane to a southbound through lane; and
    - Signalize the intersection with protective left-turn phasing in all directions.
  - Temperance Avenue / California Avenue
    - Add a second southbound through lane with receiving lane south of California Avenue; and
    - Signalize the intersection with protective left-turn phasing in all directions.

- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through lane;
  - Add a westbound right-turn lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound through lane with receiving lane south of Church Avenue;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.

### *Cumulative Year 2040 plus Project Traffic Conditions*

- Under this scenario, the intersections of Temperance Avenue and Hamilton Avenue, Temperance Avenue and California Avenue, Temperance Avenue and Truman Avenue, Armstrong Avenue and Church Avenue, and Temperance Avenue and Church Avenue 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.
  - Temperance Avenue / Hamilton Avenue
    - Open the southbound left-turn lane to allow southbound to northbound U-turns;
    - Modify the southbound left-through lane to a southbound through lane;
    - Add a southbound through lane with receiving lane south of Hamilton Avenue;
    - Modify the southbound trap right-turn lane to a typical right-turn lane; and
    - Signalize the intersection with protective left-turn phasing in all directions.
  - Temperance Avenue / California Avenue
    - Add a second southbound through lane with a receiving lane south of California Avenue; and
    - Signalize the intersection with protective left-turn phasing in all directions.

- Temperance Avenue / Truman Avenue
  - Modify the southbound right-turn lane to a through-right lane with a receiving lane south of Truman Avenue.
- Armstrong Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through-right lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound right-turn lane; and
  - Signalize the intersection with protective left-turn phasing in all directions.
- Temperance Avenue / Church Avenue
  - Add an eastbound left-turn lane;
  - Modify the eastbound left-through-right lane to a through lane;
  - Add an eastbound right-turn lane;
  - Add a westbound left-turn lane;
  - Modify the westbound left-through-right lane to a through lane;
  - Add a westbound right-turn lane;
  - Add a northbound left-turn lane;
  - Modify the northbound left-through-right lane to a through-right lane;
  - Add a southbound left-turn lane;
  - Modify the southbound left-through-right lane to a through lane;
  - Add a southbound through lane with receiving lane south of Church Avenue;
  - Add a southbound right-turn lane; and
  - 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 X 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:**

| | |
|---|---|
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**Persons Consulted:**

| | |
|---|---|
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| Jill Gormley | City of Fresno |
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| David Padilla | Caltrans |
| Kai Han | Fresno COG |
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