4.8 GREENHOUSE GAS EMISSIONS

This section describes the potential effects on greenhouse gas (GHG) emissions and climate change associated with implementation of the proposed Mitchell Farms Subdivision (project). The climate change analysis provides an estimate of the project's GHG emissions and evaluates the project's consistency with the City's Greenhouse Gas Reduction Plan (GGRP) (City of Citrus Heights 2011a). No comments were received addressing GHG emissions concerns in response to the project's Notice of Preparation. The Notice of Preparation and comments received are included in Appendix A.

The background information and impact analysis presented in this section are based on project plans, use of the California Emissions Estimator Model (CalEEMod) Version 2016.3.2 to estimate project emissions, with modeling outputs provided in Appendix E,, the *City of Citrus Heights General Plan* (City of Citrus Heights 2011b), the *City of Citrus Heights Greenhouse Gas Reduction Plan* (City of Citrus Heights 2011a), and the Sacramento Metropolitan Air Quality Management District's (SMAQMD) Guide to Air Quality Assessment in Sacramento County (SMAQMD 2016).

4.8.1 Environmental Setting

The Greenhouse Effect

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, or wind patterns, lasting for an extended period of time (decades or longer). A GHG is any gas that absorbs infrared radiation in the atmosphere; in other words, GHGs trap heat in the atmosphere. The greenhouse effect is the trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. The greenhouse effect traps heat in the troposphere through a threefold process as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth, the Earth emits a portion of this energy in the form of long-wave radiation, and GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth. The greenhouse effect is a natural process that contributes to regulating the Earth's temperature. Without it, the temperature of the Earth would be about 0°F (−18°C) instead of its present 57°F (14°C). If the atmospheric concentrations of GHGs rise, the average temperature of the lower atmosphere will gradually increase. Global climate change concerns are focused on whether human activities are leading to an enhancement of the greenhouse effect.

Greenhouse Gases

GHGs include, but are not limited to, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), O_3, water vapor, hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs),

perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Some GHGs, such as CO_2, CH_4, and N_2O, occur naturally and are emitted to the atmosphere through natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Manufactured GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as HFCs, HCFCs, PFCs, and SF_6, which are associated with certain industrial products and processes. A summary of the most common GHGs and their sources is included in the following text. The descriptions of GHGs are summarized from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (1995), IPCC Fourth Assessment Report (2007), the California Air Resources Board's (CARB's) Glossary of Terms Used in GHG Inventories (2017a), and the U.S. Environmental Protection Agency's (EPA's) Glossary of Climate Change Terms (2016).

Carbon Dioxide. CO_2 is a naturally occurring gas and a by-product of human activities and is the principal anthropogenic GHG that affects the Earth's radiative balance. Natural sources of CO_2 include respiration of bacteria, plants, animals, and fungus; evaporation from oceans, volcanic out-gassing; and decomposition of dead organic matter. Human activities that generate CO_2 are from the combustion of coal, oil, natural gas, and wood.

Methane. CH_4 is a flammable gas and is the main component of natural gas. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Nitrous Oxide. Sources of N_2O include soil cultivation practices (microbial processes in soil and water), especially the use of commercial and organic fertilizers, manure management, industrial processes (such as in nitric acid production, nylon production, and fossil-fuel-fired power plants), vehicle emissions, and the use of N_2O as a propellant (such as in rockets, racecars, aerosol sprays).

Fluorinated Gases. Fluorinated gases (also referred to as F-gases) are synthetic powerful GHGs emitted from many industrial processes. Fluorinated gases are commonly used as substitutes for stratospheric ozone-depleting substances (e.g., CFCs, HCFCs, and halons). The most prevalent fluorinated gases include the following:

- **Hydrofluorocarbons:** HFCs are compounds containing only hydrogen, fluorine, and carbon atoms. HFCs are synthetic chemicals that are used as alternatives to ozone-depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are used in manufacturing.

- **Hydrochlorofluorocarbons:** HCFCs are compounds containing hydrogen, fluorine, chlorine, and carbon atoms. HFCs are synthetic chemicals that are used as alternatives to ozone depleting substances (chlorofluorocarbons).
- **Perfluorocarbons:** PFCs are a group of human-made chemicals composed of carbon and fluorine only. These chemicals were introduced as alternatives, along with HFCs, to the ozone depleting substances. The two main sources of PFCs are primarily aluminum production and semiconductor manufacturing. Since PFCs have stable molecular structures and do not break down through the chemical processes in the lower atmosphere, these chemicals have long lifetimes, ranging between 10,000 and 50,000 years.
- **Sulfur Hexafluoride:** SF_6 is a colorless gas that is soluble in alcohol and ether and slightly soluble in water. SF_6 is used for insulation in electric power transmission and distribution equipment, semiconductor manufacturing, the magnesium industry, and as a tracer gas for leak detection.
- **Nitrogen Trifluoride:** NF_3 is used in the manufacture of a variety of electronics, including semiconductors and flat panel displays.
- **Chlorofluorocarbons:** CFCs are synthetic chemicals that have been used as cleaning solvents, refrigerants, and aerosol propellants. CFCs are chemically unreactive in the lower atmosphere (troposphere) and the production of CFCs was prohibited in 1987 due to the chemical destruction of stratospheric O_3.
- **Hydrochlorofluorocarbons:** HCFCs are a large group of compounds, whose structure is very close to that of CFCs—containing hydrogen, fluorine, chlorine, and carbon atoms—but including one or more hydrogen atoms. Like HFCs, HCFCs are used in refrigerants and propellants. HCFCs were also used in place of CFCs for some applications; however, their use in general is being phased out.

Black Carbon. Black carbon is a component of fine particulate matter, which has been identified as a leading environmental risk factor for premature death. It is produced from the incomplete combustion of fossil fuels and biomass burning, particularly from older diesel engines and forest fires. Black carbon warms the atmosphere by absorbing solar radiation, influences cloud formation, and darkens the surface of snow and ice, which accelerates heat absorption and melting. Black carbon is a short-lived species that varies spatially, which makes it difficult to quantify the global warming potential. Diesel particulate matter emissions are a major source of black carbon and are also TACs that have been regulated and controlled in California for several decades to protect public health.

Water Vapor. The primary source of water vapor is evaporation from the ocean, with additional vapor generated by sublimation (change from solid to gas) from ice and snow, evaporation from other water bodies, and transpiration from plant leaves. Water vapor is the

most important, abundant, and variable GHG in the atmosphere. It is essential to maintaining a climate necessary for life.

Ozone. Tropospheric O_3, which is created by photochemical reactions involving gases from both natural sources and human activities, acts as a GHG. Stratospheric O_3, which is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2), plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric O_3, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet-B radiation.

Aerosols. Aerosols are suspensions of particulate matter in a gas emitted into the air through burning biomass (plant material) and fossil fuels. Aerosols can warm the atmosphere by absorbing and emitting heat and can cool the atmosphere by reflecting light.

Global Warming Potential

Gases in the atmosphere can contribute to climate change both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect radiative forcing occurs when chemical transformations of the substance produce other GHGs, when a gas influences the atmospheric lifetimes of other gases, and/or when a gas affects atmospheric processes that alter the radiative balance of the Earth (e.g., affect cloud formation or albedo) (EPA 2016). The IPCC developed the global warming potential (GWP) concept to compare the relative abilities of each GHG to trap heat in the atmosphere. The GWP of a GHG is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram of a trace substance relative to that of 1 kilogram of a reference gas (IPCC 2014). The reference gas used is CO_2; therefore, GWP-weighted emissions are measured in metric tons of CO_2 equivalent (MT CO_2E).

The current version of the California Emissions Estimator Model (CalEEMod) (version 2016.3.2) assumes that the GWP for CH_4 is 25 (so emissions of 1 MT of CH_4 are equivalent to emissions of 25 MT of CO_2), and the GWP for N_2O is 298, based on the IPCC Fourth Assessment Report (IPCC 2007). The GWP values identified in CalEEMod were applied to the project.

4.8.2 Contributions to Greenhouse Gas Emissions

Per the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2015* (EPA 2017a), total United States GHG emissions were approximately 6,586.7 MMT CO_2E in 2015. The primary GHG emitted by human activities in the United States was CO_2, which represented approximately 82.2% of total GHG emissions (5,411.4 MMT CO_2E). The largest source of CO_2, and of overall GHG emissions, was fossil-fuel combustion, which accounted for approximately 93.3% of CO_2 emissions in 2015 (5,049.8 MMT CO_2E). Total United States GHG emissions have increased by 3.5% from 1990 to 2015, and emissions have decreased from 2014 to 2015 by

2.3% (153.0 MMT CO_2E). Since 1990, United States GHG emissions have increased at an average annual rate of 0.3%; however, overall, net emissions in 2015 were 11.5% below 2005 levels (EPA 2017a).

According to California's 2000–2015 GHG emissions inventory (2017 edition), California emitted 440.36 MMT CO_2E in 2015, including emissions resulting from out-of-state electrical generation (CARB 2017b). The sources of GHG emissions in California include transportation, industrial uses, electric power production from both in-state and out-of-state sources, commercial and residential uses, agriculture, high GWP substances, and recycling and waste. The California GHG emission source categories (as defined in CARB's 2008 Climate Change Scoping Plan: A Framework for Change (Scoping Plan; CARB 2008) and their relative contributions in 2015 are presented in Table 4.8-1.

Table 4.8-1
GHG Emissions Sources in California

Source Category	Annual GHG Emissions (MMT CO_2E)	Percent of Total[a]
Transportation	164.63	37%
Industrial uses	91.71	21%
Electricity generation[b]	83.67	19%
Residential and commercial uses	37.92	9%
Agriculture	34.65	8%
High-GWP substances	19.05	4%
Recycling and waste	8.73	2%
Total	**440.36**	**100%**

Source: CARB 2017b.
Notes: GHG = greenhouse gas; MMT CO_2E = million metric tons of carbon dioxide equivalent per year; GWP = global warming potential. Emissions reflect the California GHG inventory for 2015 as presented in the CARB 2017 GHG inventory edition.
[a] Percentage of total has been rounded.
[b] Includes emissions associated with imported electricity, which account for 36.51 MMT CO_2E annually.

During the 2000 to 2015 period, per capita GHG emissions in California have continued to drop from a peak in 2001 of 14.0 MT per person to 11.3 MT per person in 2015, representing a 19% decrease. In addition, total GHG emissions in 2015 were 1.5 MMT CO_2E less than 2014 emissions. The declining trend in GHG emissions, coupled with programs that will continue to provide additional reductions in GHG emissions going forward, demonstrates that California is on track to meet the 2020 target of 431 MMT CO_2E (CARB 2017b).

The City's community-wide GHG emissions inventory for baseline year 2005 is presented in Table 4.8-2. The City's GHG baseline inventory quantifies citywide GHG emissions from the year 2005. The inventory is included in the City's GGRP to identify and categorize the major sources of GHG emissions produced by community residents, businesses, and municipal

operations and was used to determine the City's target for GHG emissions in the year 2020 (City of Citrus Heights 2011a).

Table 4.8-2
City of Citrus Heights Baseline (Year 2005) Community-Wide GHG Emissions Inventory

Community Sector	Annual GHG Emissions (MT CO_2E)	Percent of Total[a]
Residential Energy Use	160,429	28%
Commercial/Industrial Energy Use	62,553	11%
On-road Mobile Sources	247,463	43%
Off-road Mobile Source	36,627	6%
Solid Waste	23,679	4%
Wastewater Treatment	8,425	2%
Water Use-related	3,525	1%
High GWP	35,433	6%
Total	**578,134**	**100%**

Source: City of Citrus Heights 2011a.
Note: GHG = greenhouse gas; GWP = Global Warming Potential; MT CO_2E = metric tons of carbon dioxide equivalent per year
[a] Percentage of total has been rounded.

As shown on Table 4.8-2, approximately 28% of the City's community-wide GHG emissions in 2005 were attributed to residential uses. Commercial and industrial uses accounted for approximately 11%. Solid waste accounted for approximately 4%, while wastewater treatment accounted for approximately 2%, water use accounted for approximately 1%, high GWP GHGs accounted for approximately 6%, and transportation (on-road and off-road mobile sources) made up the remaining 49% of community-wide GHG emissions in 2005.

Potential Effects of Human Activity on Climate Change

Globally, climate change has the potential to affect numerous environmental resources through uncertain impacts related to future air temperatures and precipitation patterns. The 2014 *Intergovernmental Panel on Climate Change Synthesis Report* indicated that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Signs that global climate change has occurred include warming of the atmosphere and ocean, diminished amounts of snow and ice have, and rising sea levels (IPCC 2014).

In California, climate change impacts have the potential to affect sea level rise, agriculture, snowpack and water supply, forestry, wildfire risk, public health, and electricity demand and supply (CCCC 2006). The primary effect of global climate change has been a 0.2°C rise in average global tropospheric temperature per decade, determined from meteorological measurements worldwide between 1990 and 2005. Scientific modeling predicts that continued emissions of GHGs at or above current rates would induce more extreme climate changes during

the twenty-first century than were observed during the twentieth century. A warming of about 0.2°C (0.36°F) per decade is projected.

Although climate change is driven by global atmospheric conditions, climate change impacts are felt locally. A scientific consensus confirms that climate change is already affecting California. The average temperatures in California have increased, leading to more extreme hot days and fewer cold nights; shifts in the water cycle have been observed, with less winter precipitation falling as snow, and both snowmelt and rainwater running off earlier in the year; sea levels have risen; and wildland fires are becoming more frequent and intense due to dry seasons that start earlier and end later (CAT 2010).

An increase in annual average temperature is a reasonably foreseeable effect of climate change. Observed changes over the last several decades across the western United States reveal clear signals of climate change. Statewide average temperatures increased by about 1.7°F from 1895 to 2011, and warming has been greatest in the Sierra Nevada (CCCC 2012). By 2050, California is projected to warm by approximately 2.7°F above 2000 averages, a threefold increase in the rate of warming over the last century. By 2100, average temperatures could increase by 4.1°F to 8.6°F, depending on emissions levels. Springtime warming—a critical influence on snowmelt—will be particularly pronounced. Summer temperatures will rise more than winter temperatures, and the increases will be greater in inland California compared to the coast. Heat waves will be more frequent, hotter, and longer. There will be fewer extremely cold nights (CCCC 2012). A decline of Sierra snowpack, which accounts for approximately half of the surface water storage in California, by 30% to as much as 90% is predicted over the next 100 years (CAT 2006).

Model projections for precipitation over California continue to show the Mediterranean pattern of wet winters and dry summers with seasonal, year-to-year, and decade-to-decade variability. For the first time, however, several of the improved climate models shift toward drier conditions by the mid-to-late 21st century in Central and, most notably, Southern California. By late-century, all projections show drying, and half of them suggest 30-year average precipitation will decline by more than 10% below the historical average (CCCC 2012).

A summary of current and future climate change impacts to resource areas in California, as discussed in Safeguarding California: Reducing Climate Risk (CNRA 2014), is provided in the following text.

Agriculture. The impacts of climate change on the agricultural sector are far more severe than the typical variability in weather and precipitation patterns that occur year to year. Some of the specific challenges faced by the agricultural sector and farmers include more drastic and unpredictable precipitation and weather patterns; extreme weather events that range from severe flooding to extreme drought, to destructive storm events; significant shifts in water availably and water

quality; changes in pollinator lifecycles; temperature fluctuations, including extreme heat stress and decreased chill hours; increased risks from invasive species and weeds, agricultural pests and plant diseases; and disruptions to the transportation and energy infrastructure supporting agricultural production. These challenges and associated short-term and long-term impacts can have both positive and negative effects on agricultural production. Nonetheless, it is predicted that current crop and livestock production will suffer long-term negative effects resulting in a substantial decrease in the agricultural sector if not managed or mitigated (CNRA 2014).

Biodiversity and Habitat. The state's extensive biodiversity stems from its varied climate and assorted landscapes, which have resulted in numerous habitats where species have evolved and adapted over time. Specific climate change challenges to biodiversity and habitat include species migration in response to climatic changes, range shift, and novel combinations of species; pathogens, parasites and disease; invasive species; extinction risks; changes in the timing of seasonal life-cycle events; food web disruptions; and threshold effects (i.e., a change in the ecosystem that results in a "tipping point" beyond which irreversible damage or loss has occurs). Habitat restoration, conservation, and resource management across California and through collaborative efforts amongst public, private, and nonprofit agencies has assisted in the effort to fight climate change impacts on biodiversity and habitat. One of the key measures in these efforts is ensuring species' ability to relocate as temperature and water availability fluctuate as a result of climate change, based on geographic region.

Energy. The energy sector provides California residents with a supply of reliable and affordable energy through a complex integrated system. Specific climate change challenges for the energy sector include temperature, fluctuating precipitation patterns, increasing extreme weather events and sea level rise. Increasing temperatures and reduced snowpack negatively impact the availability of a steady flow of snowmelt to hydroelectric reservoirs. Higher temperatures also reduce the capacity of thermal power plants since power plant cooling is less efficient at higher ambient temperatures. Natural gas infrastructure in coastal California is threatened by sea level rise and extreme storm events (CNRA 2014).

Forestry. Forests occupy approximately 33% of California's 100 million acres and provide key benefits such as wildlife habitat, absorption of CO_2, renewable energy, and building materials. The most significant climate change related risk to forests is accelerated risk of wildfire and more frequent and severe droughts. Droughts have resulted in more large scale tree mortality and combined with increasing temperatures have led to an overall increase in wildfire risks. Increased wildfire intensity subsequently increases public safety risks, property damage, fire suppression and emergency response costs, watershed and water quality impacts, and vegetation conversions. These factors contribute to decreased forest growth, geographic shifts in tree distribution, loss of fish and wildlife habitat, and decreased carbon absorption. Climate change may result in increased establishment of non-native species, particularly in rangelands where

invasive species are already a problem. Invasive species may be able to exploit temperature or precipitation changes, or quickly occupy areas denuded by fire, insect mortality, or other climate change effects on vegetation (CNRA 2014).

Ocean and Coastal Ecosystems and Resources. Sea level rise, changing ocean conditions and other climate change stressors are likely to exacerbate long-standing challenges related to ocean and coastal ecosystems in addition to threatening people and infrastructure located along the California coastline and in coastal communities. Sea level rise in addition to more frequent and severe coastal storms and erosion are threatening vital infrastructure such as roads, bridges, power plants, ports and airports, gasoline pipes, and emergency facilities, as well as negatively impacting the coastal recreational assets such as beaches and tidal wetlands. Water quality and ocean acidification threaten the abundance of seafood and other plant and wildlife habitats throughout California and globally (CNRA 2014).

Public Health. Climate change can impact public health through various environmental changes and is the largest threat to human health in the twenty-first century. Changes in precipitation patterns affect public health primarily through potential for altered water supplies, and extreme events such as heat, floods, droughts, and wildfires. Increased frequency, intensity and duration of extreme heat and heat waves is likely to increase the risk of mortality due to heat related illness as well as exacerbate existing chronic health conditions. Other extreme weather events are likely to negatively impact air quality and increase or intensify respiratory illness such as asthma and allergies. Additional health impacts that may be impacted by climate change include cardiovascular disease, vector-borne diseases, mental health impacts, and malnutrition injuries. Increased frequency of these ailments is likely to subsequently increase the direct risk of injury and/or mortality (CNRA 2014).

Transportation. Residents of California rely on airports, seaports, public transportation, and an extensive roadway network to gain access to destinations, goods and services. While the transportation industry is a source of GHG emissions, it is also vulnerable to climate change risks. Particularly, sea level rise and erosion threaten many coastal California roadways, airports, seaports, transit systems, bridge supports, and energy and fueling infrastructure. Increasing temperatures and extended periods of extreme heat threaten the integrity of the roadways and rail lines. High temperatures cause the road surfaces to expand which leads to increased pressure and pavement buckling. High temperatures can also cause rail breakages, which could lead to train derailment. Other forms of extreme weather events, such as extreme storm events, can negatively impact infrastructure which can impair movement of peoples and goods, or potentially block evacuation routes and emergency access roads. Increased wildfires, flooding, erosion risks, landslides, mudslides, and rockslides can all profoundly impact the transportation system and pose a serious risk to public safety (CNRA 2014).

Water. Water resources in California support residences, plants, wildlife, farmland, landscapes, and ecosystems and bring trillions of dollars in economic activity. Climate change could seriously impact the timing, form, amount of precipitation, runoff patterns, and frequency and severity of precipitation events. Higher temperatures reduce the amount of snowpack and lead to earlier snowmelt, which can impact water supply availability, natural ecosystems, and winter recreation. Water supply availability during the intense dry summer months is heavily dependent on the snowpack accumulated during the winter time. Increased risk of flooding has a variety of public health concerns including water quality, public safety, property damage, displacement, and post-disaster mental health problems. Prolonged and intensified droughts can also negatively impact groundwater reserves and result in increased overdraft and subsidence. Droughts can also negatively impact agriculture and farmland throughout the state. The higher risk of wildfires can lead to increased erosion, which can negatively impact watersheds and result in poor water quality. Water temperatures are also prone to increase, which can negatively impact wildlife that rely on a specific range of temperatures for suitable habitat (CNRA 2014).

In March 2016, the CNRA released *Safeguarding California: Implementation Action Plans*, a document that shows how California is acting to convert the recommendations contained in the 2014 *Safeguarding California* plan into action (CNRA 2016). Additionally, in May 2017, CNRA released the draft *Safeguarding California Plan: 2017 Update*, which is a survey of current programmatic responses for climate change and contains recommendations for further actions (CNRA 2017).

4.8.2 Regulatory Setting

GHG emissions are monitored through the efforts of various international, federal, state, regional, and local government agencies. The agencies work jointly and individually to reduce GHG emissions through legislation, regulations, planning, policy making, education, and a variety of programs. The agencies responsible for regulating contributors to climate change within the City of Citrus Heights (City) are discussed in the following text.

Federal Regulations

Massachusetts vs. EPA. On April 2, 2007, in *Massachusetts v. EPA*, the Supreme Court directed the EPA Administrator to determine whether GHG emissions from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the EPA Administrator is required to follow the language of Section 202(a) of the Clean Air Act. On December 7, 2009, the EPA Administrator signed a final rule with the following two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act:

- The Administrator found that elevated concentrations of GHGs—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations. This is referred to as the "endangerment finding."

- The Administrator further found the combined emissions of GHGs—CO_2, CH_4, N_2O, and HFCs—from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare. This is referred to as the "cause or contribute finding."

These two findings were necessary to establish the foundation for regulation of GHGs from new motor vehicles as air pollutants under the Clean Air Act.

Energy Independence and Security Act of 2007. On December 19, 2007, President George W. Bush signed the Energy Independence and Security Act of 2007. Among other key measures, the Act would do the following, which would aid in the reduction of national GHG emissions:

1. Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard requiring fuel producers to use at least 36 billion gallons of biofuel in 2022.
2. Set a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020 and directs National Highway Traffic Safety Administration (NHTSA) to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks.
3. Prescribe or revise standards affecting regional efficiency for heating and cooling products and procedures for new or amended standards, energy conservation, energy-efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

Federal Vehicle Standards. In response to the U.S. Supreme Court ruling discussed above, the Bush Administration issued Executive Order (EO) 13432 in 2007 directing the EPA, the Department of Transportation (DOT), and the Department of Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. In 2009, the NHTSA issued a final rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011; and, in 2010, the EPA and NHTSA issued a final rule regulating cars and light-duty trucks for model years 2012–2016.

In 2010, President Obama issued a memorandum directing the DOT, DOE, EPA, and NHTSA to establish additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure. In response to this directive, the EPA and NHTSA proposed stringent, coordinated federal GHG and fuel economy standards for model years 2017–2025 light-duty vehicles. The proposed standards projected to achieve 163 grams per mile of CO_2 in model year 2025, on an average industry fleet-wide basis, which is equivalent to 54.5 miles per gallon if this level were achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017–2021. On January 12, 2017, EPA finalized its decision to maintain the current GHG emissions standards for model years 2022–2025 cars and light trucks (EPA 2017b).

In addition to the regulations applicable to cars and light-duty trucks described above, in 2011, the EPA and NHTSA announced fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014–2018. The standards for CO_2 emissions and fuel consumption are tailored to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. According to the EPA, this regulatory program will reduce GHG emissions and fuel consumption for the affected vehicles by 6%–23% over the 2010 baselines.

In August 2016, the EPA and NHTSA announced the adoption of the phase two program related to the fuel economy and GHG standards for medium- and heavy-duty trucks. The phase two program will apply to vehicles with model year 2018 through 2027 for certain trailers, and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans and all types of sizes of buses and work trucks. The final standards are expected to lower carbon dioxide emissions by approximately 1.1 billion MT and reduce oil consumption by up to two billion barrels over the lifetime of the vehicles sold under the program (EPA and NHTSA 2016).

Clean Power Plan and New Source Performance Standards for Electric Generating Units. On October 23, 2015, EPA published a final rule (effective December 22, 2015) establishing the Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (80 FR 64510–64660), also known as the Clean Power Plan. These guidelines prescribe how states must develop plans to reduce GHG emissions from existing fossil-fuel-fired electric generating units. The guidelines establish CO_2 emission performance rates representing the best system of emission reduction for two subcategories of existing fossil-fuel-fired electric generating units: (1) fossil-fuel-fired electric utility steam-generating units, and (2) stationary combustion turbines. Concurrently, EPA published a final rule (effective October 23, 2015) establishing Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units (80 FR 64661–65120). The rule prescribes CO_2 emission standards for newly constructed, modified, and reconstructed affected fossil-fuel-fired electric utility generating units. Implementation of the Clean Power Plan has been stayed by the U.S. Supreme Court pending resolution of several lawsuits. In October 2017, the EPA proposed to repeal the Clean Power Plan.

State Regulations

Executive Order (EO) S-3-05. EO S-3-05 (June 2005) established the following statewide goals: GHG emissions should be reduced to 2000 levels by 2010, GHG emissions should be reduced to 1990 levels by 2020, and GHG emissions should be reduced to 80% below 1990 levels by 2050.

Assembly Bill (AB) 32 and CARB's Climate Change Scoping Plan. In furtherance of the goals established in EO S-3-05, the Legislature enacted Assembly Bill 32, the California Global

Warming Solutions Act of 2006. AB 32 requires California to reduce its GHG emissions to 1990 levels by 2020.

Under AB 32, CARB is responsible for and is recognized as having the expertise to carry out and develop the programs and requirements necessary to achieve the GHG emissions reduction mandate of AB 32. Under AB 32, CARB must adopt regulations requiring the reporting and verification of statewide GHG emissions from specified sources. This program is used to monitor and enforce compliance with established standards. CARB also is required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. AB 32 relatedly authorized CARB to adopt market-based compliance mechanisms to meet the specified requirements. Finally, CARB is ultimately responsible for monitoring compliance and enforcing any rule, regulation, order, emission limitation, emission reduction measure, or market-based compliance mechanism adopted.

In 2007, CARB approved a limit on the statewide GHG emissions level for year 2020 consistent with the determined 1990 baseline (427 MMT CO_2E). CARB's adoption of this limit is in accordance with Health and Safety Code Section 38550.

Further, in 2008, CARB adopted the *Climate Change Scoping Plan: A Framework for Change* (Scoping Plan) in accordance with Health and Safety Code Section 38561. The Scoping Plan establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions for various emission sources/sectors to 1990 levels by 2020. The Scoping Plan evaluates opportunities for sector-specific reductions, integrates all CARB and Climate Action Team early actions and additional GHG reduction features by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program. The key elements of the Scoping Plan include the following (CARB 2008):

1. Expanding and strengthening existing energy efficiency programs as well as building and appliance standards
2. Achieving a statewide renewable energy mix of 33%
3. Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions
4. Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets
5. Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard

6. Creating targeted fees, including a public goods charge on water use, fees on high GWP gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation

In the 2011 Final Supplement to the Scoping Plan's Functional Equivalent Document, CARB determined that achieving the 1990 emissions level by 2020 would require a reduction in GHG emissions of 21.7% from the business-as-usual conditions. When the 2020 emissions level projection also was updated to account for newly implemented regulatory measures, including Pavley I (model years 2009–2016) and the Renewables Portfolio Standard (12% to 20%), CARB determined that achieving the 1990 emissions level in 2020 would require a reduction in GHG emissions of 16% from the business-as-usual conditions.

In 2014, CARB adopted the *First Update to the Climate Change Scoping Plan: Building on the Framework* (First Update). The stated purpose of the First Update is to "highlight California's success to date in reducing its GHG emissions and lay the foundation for establishing a broad framework for continued emission reductions beyond 2020, on the path to 80% below 1990 levels by 2050." The First Update found that California is on track to meet the 2020 emissions reduction mandate established by AB 32, and noted that California could reduce emissions further by 2030 to levels squarely in line with those needed to stay on track to reduce emissions to 80% below 1990 levels by 2050 if the state realizes the expected benefits of existing policy goals.

In conjunction with the First Update, CARB identified "six key focus areas comprising major components of the state's economy to evaluate and describe the larger transformative actions that will be needed to meet the state's more expansive emission reduction needs by 2050." Those six areas are energy, transportation (vehicles/equipment, sustainable communities, housing, fuels, and infrastructure), agriculture, water, waste management, and natural and working lands. The First Update identifies key recommended actions for each sector that will facilitate achievement of EO S-3-05's 2050 reduction goal.

Based on CARB's research efforts presented in the First Update, it has a "strong sense of the mix of technologies needed to reduce emissions through 2050." Those technologies include energy demand reduction through efficiency and activity changes; large-scale electrification of on-road vehicles, buildings, and industrial machinery; decarbonizing electricity and fuel supplies; and the rapid market penetration of efficient and clean energy technologies.

As part of the First Update, CARB recalculated the state's 1990 emissions level using more recent global warming potentials identified by the IPCC. Using the recalculated 1990 emissions level (431 MMT CO_2E) and the revised 2020 emissions level projection identified in the 2011 Final Supplement, CARB determined that achieving the 1990 emissions level by 2020 would

require a reduction in GHG emissions of approximately 15% (instead of the 16% reduction identified in the 2011 Final Supplement) from the business-as-usual conditions.

On January 20, 2017, CARB released The *2017 Climate Change Scoping Plan Update* (Second Update) for public review and comment (CARB 2017b). This update presents CARB's strategy for achieving the state's 2030 GHG target as established in SB 32 (discussed below), including continuing the Cap-and-Trade Program through 2030, and includes a new approach to reduce GHGs from refineries by 20%. The Second Update incorporates approaches to cutting short-lived climate pollutants (SLCPs) under the Short-Lived Climate Pollutant Reduction Strategy (a planning document that was adopted by CARB in March 2017; CARB 2017c), and acknowledges the need for reducing emissions in agriculture and highlights the work underway to ensure that California's natural and working lands increasingly sequester carbon. During development of the Second Update, CARB held a number of public workshops in the Natural and Working Lands, Agriculture, Energy, and Transportation sectors to inform development of the 2030 Scoping Plan Update (CARB 2016). When discussing project-level GHG emissions reduction actions and thresholds, the Second Update states "achieving no net increase in GHG emissions is the correct overall objective, but it may not be appropriate or feasible for every development project. An inability to mitigate a project's GHG emissions to zero does not necessarily imply a substantial contribution to the cumulatively significant environmental impact of climate change under CEQA" (CARB 2017d). The Second Update was approved by CARB's Governing Board on December 14, 2017.

EO B-30-15. EO B-30-15 (April 2015) identified an interim GHG reduction target in support of targets previously identified under EO S-3-05 and AB 32. EO B-30-15 set an interim target goal of reducing statewide GHG emissions to 40% below 1990 levels by 2030 to keep California on its trajectory toward meeting or exceeding the long-term goal of reducing statewide GHG emissions to 80% below 1990 levels by 2050 as set forth in EO S-3-05. To facilitate achievement of this goal, EO B-30-15 calls for an update to CARB's Scoping Plan to express the 2030 target in terms of MMT CO_2E. The EO also calls for state agencies to continue to develop and implement GHG emission reduction programs in support of the reduction targets. EO B-30-15 does not require local agencies to take any action to meet the new interim GHG reduction target.

SB 32 and AB 197. SB 32 and AB 197 (enacted in 2016) are companion bills. SB 32 codified the 2030 emissions reduction goal of EO B-30-15 by requiring CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030. AB 197 established the Joint Legislative Committee on Climate Change Policies, consisting of at least three members of the Senate and three members of the Assembly, in order to provide ongoing oversight over implementation of the state's climate policies. AB 197 also added two members of the Legislature to the Board as nonvoting members; requires CARB to make available and update (at least annually via its website) emissions data for GHGs, criteria air pollutants, and TACs from

reporting facilities; and, requires CARB to identify specific information for GHG emissions reduction measures when updating the scoping plan.

SB 605 and SB 1383. SB 605 (2014) requires CARB to complete a comprehensive strategy to reduce emissions of SLCPs in the state; SB 1383 (2016) requires CARB to approve and implement that strategy by January 1, 2018. SB 1383 also establishes specific targets for the reduction of SLCPs (40% below 2013 levels by 2030 for methane and HFCs, and 50% below 2013 levels by 2030 for anthropogenic black carbon), and provides direction for reductions from dairy and livestock operations and landfills. Accordingly, and as mentioned above, CARB adopted its *Short-Lived Climate Pollutant Reduction Strategy* (SLCP Reduction Strategy) in March 2017. The *SLCP Reduction Strategy* establishes a framework for the statewide reduction of emissions of black carbon, methane and fluorinated gases.

Building Energy

Title 24, Part 6. Title 24 of the California Code of Regulations was established in 1978 and serves to enhance and regulate California's building standards. While not initially promulgated to reduce GHG emissions, Part 6 of Title 24 specifically established Building Energy Efficiency Standards that are designed to ensure new and existing buildings in California achieve energy efficiency and preserve outdoor and indoor environmental quality. These energy efficiency standards are reviewed every few years by the Building Standards Commission and the California Energy Commission (CEC) (and revised if necessary) (California Public Resources Code, Section 25402(b)(1)). The regulations receive input from members of industry, as well as the public, with the goal of "reducing of wasteful, uneconomic, inefficient, or unnecessary consumption of energy" (California Public Resources Code, Section 25402). These regulations are carefully scrutinized and analyzed for technological and economic feasibility (California Public Resources Code, Section 25402(d)) and cost effectiveness (California Public Resources Code, Sections 25402(b)(2) and (b)(3)). As a result, these standards save energy, increase electricity supply reliability, increase indoor comfort, avoid the need to construct new power plants, and help preserve the environment.

The current Title 24 standards are the 2016 Title 24 building energy efficiency standards, which became effective January 1, 2017. The updated standards will further reduce energy used and associated GHG emissions compared to previous standards, such as the 2013 Title 24 standards. In general, single-family homes built to the 2016 standards are anticipated to use about 28% less energy for lighting, heating, cooling, ventilation, and water heating than those built to the 2013 standards, and nonresidential buildings built to the 2016 standards will use an estimated 5% less energy than those built to the 2013 standards (CEC 2015).

Title 24, Part 11. In addition to the CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24) is commonly referred to as CALGreen, and establishes minimum mandatory standards as well as voluntary standards pertaining to the planning and design of sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and interior air quality. The CALGreen standards took effect in January 2011 and instituted mandatory minimum environmental performance standards for all ground-up, new construction of commercial, low-rise residential and state-owned buildings and schools and hospitals. The CALGreen 2016 standards became effective January 1, 2017 (CALGreen 2016). The mandatory standards require the following (24 CCR Part 11):

- Mandatory reduction in indoor water use through compliance with specified flow rates for plumbing fixtures and fittings
- Mandatory reduction in outdoor water use through compliance with a local water efficient landscaping ordinance or the California Department of Water Resources' Model Water Efficient Landscape Ordinance
- 65% of construction and demolition waste must be diverted from landfills
- Mandatory inspections of energy systems to ensure optimal working efficiency
- Inclusion of electric vehicle charging stations or designated spaces capable of supporting future charging stations
- Low-pollutant emitting exterior and interior finish materials, such as paints, carpets, vinyl flooring, and particle boards

The CALGreen standards also include voluntary efficiency measures that are provided at two separate tiers and implemented at the discretion of local agencies and applicants. CALGreen's Tier 1 standards call for a 15% improvement in energy requirements; stricter water conservation, 65% diversion of construction and demolition waste, 10% recycled content in building materials, 20% permeable paving, 20% cement reduction, and cool/solar-reflective roofs. CALGreen's more rigorous Tier 2 standards call for a 30% improvement in energy requirements, stricter water conservation, 80% diversion of construction and demolition waste, 15% recycled content in building materials, 30% permeable paving, 25% cement reduction, and cool/solar-reflective roofs.

The California Public Utilities Commission (CPUC), CEC, and CARB also have a shared, established goal of achieving zero net energy (ZNE) performance for new construction in California.

The key policy timelines include: (1) all new residential construction in California will be ZNE by 2020, and (2) all new commercial construction in California will be ZNE by 2030.[1]

Title 20. Title 20 of the California Code of Regulations requires manufacturers of appliances to meet state and federal standards for energy and water efficiency. The CEC certifies an appliance based on a manufacturer's demonstration that the appliance meets the standards. New appliances regulated under Title 20 include: refrigerators, refrigerator-freezers and freezers; room air conditioners and room air-conditioning heat pumps; central air conditioners; spot air conditioners; vented gas space heaters; gas pool heaters; plumbing fittings and plumbing fixtures; fluorescent lamp ballasts; lamps; emergency lighting; traffic signal modules; dishwaters; clothes washers and dryers; cooking products; electric motors; low voltage dry-type distribution transformers; power supplies; televisions and consumer audio and video equipment; and battery charger systems. Title 20 presents protocols for testing each type of appliance covered under the regulations and appliances must meet the standards for energy performance, energy design, water performance and water design. Title 20 contains three types of standards for appliances: federal and state standards for federally regulated appliances, state standards for federally regulated appliances, and state standards for non-federally regulated appliances.

Renewable Energy and Energy Procurement

SB 1078. SB 1078 (Sher) (September 2002) established the Renewable Portfolio Standard (RPS) program, which required an annual increase in renewable generation by the utilities equivalent to at least 1% of sales, with an aggregate goal of 20% by 2017. This goal was subsequently accelerated, requiring utilities to obtain 20% of their power from renewable sources by 2010 (see SB 107, EO S-14-08, and S-21-09).

SB X1 2. SB X1 2 (2011) expanded the RPS by establishing that 20% of the total electricity sold to retail customers in California per year by December 31, 2013, and 33% by December 31, 2020, and in subsequent years be secured from qualifying renewable energy sources. Under the bill, a renewable electrical generation facility is one that uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 megawatts or less, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and that meets other specified requirements with respect to its location. In addition to the retail sellers previously covered by the RPS, SB X1 2 added local, publicly owned electric utilities to the RPS.

1 See, e.g., CPUC, California's Zero Net Energy Policies and Initiatives, Sept. 18, 2013, accessed at http://annualmeeting.naseo.org/Data/Sites/2/presentations/Fogel-Getting-to-ZNE-CA-Experience.pdf. It is expected that achievement of the ZNE goal will occur via revisions to the Title 24 standards.

SB 350. SB 350 (2015) further expanded the RPS by establishing that 50% of the total electricity sold to retail customers in California per year by December 31, 2030 be secured from qualifying renewable energy sources. In addition, SB 350 includes the goal to double the energy efficiency savings in electricity and natural gas final end uses (such as heating, cooling, lighting, or class of energy uses on which an energy-efficiency program is focused) of retail customers through energy conservation and efficiency. The bill also requires the CPUC, in consultation with the CEC, to establish efficiency targets for electrical and gas corporations consistent with this goal.

Mobile Sources

AB 1493. AB 1493 (Pavley) (July 2002) was enacted in a response to the transportation sector accounting for more than half of California's CO_2 emissions. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles that are primarily used for noncommercial personal transportation in the state. The bill required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004. When fully phased in, the near-term (2009–2012) standards will result in a reduction of about 22% in GHG emissions compared to the emissions from the 2002 fleet, while the mid-term (2013–2016) standards will result in a reduction of about 30%.

EO S-1-07. Issued on January 18, 2007, EO S-1-07 sets a declining Low Carbon Fuel Standard (LCFS) for GHG emissions measured in CO_2E grams per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10% by 2020. The carbon intensity measures the amount of GHG emissions in the lifecycle of a fuel, including extraction/feedstock production, processing, transportation, and final consumption, per unit of energy delivered. CARB adopted the implementing regulation in April 2009. The regulation is expected to increase the production of biofuels, including those from alternative sources, such as algae, wood, and agricultural waste.

SB 375. SB 375 (Steinberg) (September 2008) addresses GHG emissions associated with the transportation sector through regional transportation and sustainability plans. SB 375 requires CARB to adopt regional GHG reduction targets for the automobile and light-truck sector for 2020 and 2035 and to update those targets every 8 years. SB 375 requires the state's 18 regional metropolitan planning organizations (MPOs) to prepare a Sustainable Communities Strategy (SCS) as part of their Regional Transportation Plan that will achieve the GHG reduction targets set by CARB. If a MPO is unable to devise an SCS to achieve the GHG reduction target, the MPO must prepare an Alternative Planning Strategy demonstrating how the GHG reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

Pursuant to Government Code, Section 65080(b)(2)(K), a SCS does not: (i) regulate the use of land; (ii) supersede the land use authority of cities and counties; or (iii) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it. Nonetheless, SB 375 makes regional and local planning agencies responsible for developing those strategies as part of the federally required metropolitan transportation planning process and the state-mandated housing element process.

CARB set SB 375 GHG reduction targets for the Sacramento region at 7% below 2005 per capita emissions by 2020 and 16% below 2005 per capita emissions by 2035. In February 2016, the Sacramento Area Council of Governments (SACOG), the designated MPO for the Sacramento region, adopted the *2016 Metropolitan Transportation Plan/Sustainable Communities Strategy* (2016 MTP/SCS) (SACOG 2016). The 2016 MTP/SCS demonstrates that, if implemented, the region will achieve an 8% per capita GHG reduction in passenger vehicle emissions in 2020 and a 16% reduction in 2035. These reductions meet the GHG targets for SACOG as discussed above.

Advanced Clean Cars Program. In January 2012, CARB approved the Advanced Clean Cars program, a new emissions-control program for model years 2015 through 2025. The program combines the control of smog- and soot-causing pollutants and GHG emissions into a single coordinated package. The package includes elements to reduce smog-forming pollution, reduce GHG emissions, promote clean cars, and provide the fuels for clean cars (CARB 2011). To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that in 2025 cars will emit 75% less smog-forming pollution than the average new car sold before 2012. To reduce GHG emissions, CARB, in conjunction with the EPA and the NHTSA, has adopted new GHG standards for model year 2017 to 2025 vehicles; the new standards are estimated to reduce GHG emissions by 34% in 2025. The Zero Emissions Vehicle (ZEV) program will act as the focused technology of the Advanced Clean Cars program by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles in the 2018 to 2025 model years.

Solid Waste

AB 939 and AB 341. In 1989, AB 939, known as the Integrated Waste Management Act (California Public Resources Code, Sections 40000 et seq.), was passed because of the increase in waste stream and the decrease in landfill capacity. The statute established the California Integrated Waste Management Board, which oversees a disposal reporting system. AB 939 mandated a reduction of waste being disposed where jurisdictions were required to meet diversion goals of all solid waste through source reduction, recycling, and composting activities of 25% by 1995 and 50% by the year 2000.

AB 341 (Chapter 476, Statutes of 2011 (Chesbro)) amended the California Integrated Waste Management Act of 1989 to include a provision declaring that it is the policy goal of the state that not less than 75% of solid waste generated be source-reduced, recycled, or composted by the year 2020, and annually thereafter. In addition, AB 341 required the California Department of Resources Recycling and Recovery (CalRecycle) to develop strategies to achieve the state's policy goal. CalRecycle conducted several general stakeholder workshops and several focused workshops and in August 2015 published a discussion document titled AB 341 Report to the Legislature, which identifies five priority strategies that CalRecycle believes would assist the state in reaching the 75% goal by 2020, legislative and regulatory recommendations and an evaluation of program effectiveness (CalRecycle 2015).

Water

EO B-29-15. In response to the ongoing drought in California, EO B-29-15 (April 2015) set a goal of achieving a statewide reduction in potable urban water usage of 25% relative to water use in 2013. The term of the EO extended through February 28, 2016, although many of the directives have become permanent water-efficiency standards and requirements. The EO includes specific directives that set strict limits on water usage in the state. In response to EO B-29-15, the California Department of Water Resources has modified and adopted a revised version of the Model Water Efficient Landscape Ordinance that, among other changes, significantly increases the requirements for landscape water use efficiency and broadens its applicability to include new development projects with smaller landscape areas.

Other State Actions

SB 97. SB 97 (Dutton) (August 2007) directed the Governor's Office of Planning and Research (OPR) to develop guidelines under CEQA for the mitigation of GHG emissions. The CNRA adopted the CEQA Guidelines amendments in December 2009, which became effective in March 2010.

Under the amended Guidelines, a lead agency has the discretion to determine whether to use a quantitative or qualitative analysis or apply performance standards to determine the significance of GHG emissions resulting from a particular project (14 CCR 15064.4(a)). The Guidelines require a lead agency to consider the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions (14 CCR 15064.4(b)). The Guidelines also allow a lead agency to consider feasible means of mitigating the significant effects of GHG emissions, including reductions in emissions through the implementation of project features or off-site measures. The adopted amendments do not establish a GHG emission threshold, instead allowing a Lead Agency to develop, adopt, and apply its own thresholds of significance or those developed by other agencies or experts. The CNRA also acknowledges that a lead agency may consider

compliance with regulations or requirements implementing AB 32 in determining the significance of a project's GHG emissions (CNRA 2009).

Local Regulations

Sacramento Area Council of Governments Sustainable Communities Strategy

In February 2016, SACOG, the designated MPO for the Sacramento region, adopted the 2036 MTP/SCS (SACOG 2016). The MTP/SCS is a long-range plan for transportation projects within the planning area and focuses on cost-effective operational improvements to preserve the existing and expanded regional transportation system through 2035. The 2016 update to the MTP/SCS focused on refinement of and addressing implementation challenges to the previous (2012) plan. The SACOG Board of Directors has adopted five guiding policy themes including, land use forecast, transportation funding, investment strategy, investment timing, and plan effects which provide direction for the plan update.

Sacramento Region Blueprint

In 2004, SACOG adopted the Preferred Blueprint Scenario for 2050 (Blueprint). The Blueprint depicts a way for the region to grow through 2050 in a manner consistent with the seven smart growth principals: (1) transportation choices; (2) mixed-use developments; (3) compact development; (4) housing choice and diversity; (5) use of existing assets; (6) quality design, and (7) natural resources conservation. The seven smart growth principals provide guidance for land use planners which, when implemented, would ultimately result in an overall reduction in vehicle miles traveled (VMT), emissions of criteria pollutants, and GHG emissions.

City of Citrus Heights General Plan

The City of Citrus Heights updated its General Plan in August 2011. Applicable climate change goals and policies from Chapter 3, Resource Conservation, are listed below (City of Citrus Heights 2011b):

Goal 40: Promote energy conservation through appropriate design and construction techniques.

Policy 40.1: Encourage new buildings to maximize solar access to promote passive solar energy use, natural ventilation, effective use of daylight, and on-site solar generation.

Policy 40.2: Promote a climate-appropriate tree planting and maintenance program in order to reduce ambient air temperature on hot sunny days, and require that all tree plantings and outdoor lighting be integrated.

Goal 41: Minimize building energy consumption and transition to clean, renewable energy sources.

Policy 41.1: Require energy-efficient site and building designs in new construction.

Goal 55: Reduce community-wide GHG emissions 10 to 15% below 2005 levels by 2020

Policy 55.1: Implement a comprehensive greenhouse gas reduction plan to reduce communitywide greenhouse gasses through community engagement and leadership; land use, community design, and transportation choices; energy and water conservation techniques; solid waste reduction and building green infrastructure.

The City's GGRP, discussed below, identifies specific actions the City will take to achieve the GHG emissions reduction target established in Goal 55. Goals and policies in other sections of the General Plan will also support the City in achieving the GHG emissions reduction target. These include goals and policies related to land use, transportation, energy and water conservation, waste reduction and increasing green infrastructure.

City of Citrus Heights Greenhouse Gas Reduction Plan

The City's GGRP recommends communitywide strategies and measures aimed at collectively reducing GHG emissions by approximately 13.7% below 2005 levels to achieve the City's adopted emission reduction target (10% to 15% below 2005 baseline emission levels by 2020) consistent with the State's plan to achieve GHG reductions required in the Scoping Plan and AB 32 which identifies that local jurisdictions must meet the state-wide target by reducing GHG emissions below baseline levels. The GHG reduction measures within the GGRP address communitywide emissions within the City's control, to ensure the City meets its fair share responsibility to achieve GHG reductions above and beyond statewide reductions, such as implementation of statewide low carbon fuel standards, vehicle fuel efficiency standards, and renewable energy portfolio standards. Specific GHG reduction measures in the GGRP are grouped within seven strategy areas – community leadership and engagement, land use and community design, transportation and connectivity, energy efficiency and conservation, water efficiency and conservation, waste reduction, green infrastructure, and public health and safety. The GHG reduction measures were developed by (a) evaluating existing community conditions, (b) identifying emissions reduction opportunities within the City, (c) reviewing best practices from other jurisdictions and organizations, and (d) incorporating state and regional laws, guidelines, and recommendations. The GGRP includes two types of measures: primary and supporting measures. Primary measures result in directly attributable GHG reductions based on current technology, empirical studies and available data. The GGRP recommends 19 primary

measures that when implemented will help the City the target of 10% to 15% below 2005 levels. Together with the effects of AB 1493 and LCFS in Citrus Heights, the GGRP measures would enable a combined reduction of about 24.5% below 2005 levels by 2020.

4.8.3 Impacts

Methods of Analysis

The issue of global climate change is inherently a cumulative issue as the GHG emissions of individual projects cannot be shown to have any material effect on global climate. Thus, the project's impact to climate change is addressed only as a cumulative impact.

As previously discussed, the Citrus Heights General Plan identifies the City's goal of reducing GHG emissions to between 10% and 15% below 2005 levels by 2020 to ensure that the City does not impede achievement of the State's GHG reduction goals. The GGRP was adopted in 2011 in conjunction with adoption of the City's General Plan and evaluated in the City's General Plan EIR (Citrus Heights 2011c). To determine whether a project would conflict with the GGRP, and thus result in a significant impact, a numeric threshold of significance was calculated based on the emissions projections in the GGRP and population projections in the General Plan. The GHG emissions inventory in the GGRP indicates that there were 543,727 MT CO_2E emissions in 2005. Achieving the 2020 emissions target would require reducing emissions to a total of 410,719 MT CO_2E. With a population of approximately 86,593 residents in 2005 and a projected population of 92,949 residents in 2020 (Citrus Heights 2011b), emissions would need to be reduced from 6.3 MT per capita (in 2005) to 4.4 MT per capita to achieve the City's target for GHG emissions in 2020. A project that achieves GHG emissions of 4.4 MT per capita or less would be consistent with the GGRP and would not impede local or state efforts to reduce GHG emissions.

To provide a full understanding of the project's potential contribution to climate change, the project's short-term construction-related and long-term operational GHG emissions were estimated using the CalEEMod software. The model quantifies direct GHG emissions from construction and operation (including vehicle use), as well as indirect GHG emissions, such as GHG emissions from energy use, solid waste disposal, and water use.

Significance Criteria

The significance criteria for evaluating GHG impacts associated with the implementation of the proposed project are as follows. Would the proposed project:

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
- Conflict with the Citrus Heights GGRP?

Project Impacts

IMPACT 4.8-1:	Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment
SIGNIFICANCE:	Potentially Significant
MITIGATION MEASURE:	Mitigation Measure 4.8a
SIGNIFICANCE AFTER MITIGATION:	Less than Significant

Construction

Construction of the project would result in GHG emissions primarily associated with the use of off-road construction equipment, on-road hauling and vendor (material delivery) trucks, and worker vehicles. CalEEMod Version 2016.3.2 was used to calculate the annual GHG emissions based on the construction scenario described in Section 4.7 (Air Quality). The construction equipment assumptions utilized in the CalEEMod model are summarized in Appendix E and are based on the default number of equipment in addition to construction phasing information supplied by the project applicant. Table 4.8-3 presents the project's construction CO_2E emissions from January 2018 to April 2022. Detailed modeling outputs are also provided in Appendix E.

Table 4.8-3
Project Estimated Annual Construction GHG Emissions

Year	Emissions (MT CO_2E)
2018	304.79
2019	568.86
2020	430.89
2021	298.58
2022	79.11
Total	**1,682.23**
Amortized Annual Contribution	56.07

Source: Appendix E

Consistent with the analysis methodology in the General Plan EIR (City of Citrus Heights 2011c), construction-related GHG emissions are amortized over the life of the project (30 years) and added to the projected annual operational GHG emissions, as discussed below.

Operations

Operation of the project would result in GHG emissions from vehicular traffic, area sources (e.g., natural gas combustion and landscaping), electrical generation, water supply, and solid waste as described below.

Vehicular Traffic

Trip rates and traffic volumes provided in the project's Transportation Impact Study were incorporated into CalEEMod in order to match the daily trips identified in the project traffic impact analysis, included as Appendix C of this EIR. Notably, the CalEEMod default average weekday trip rates for the project were updated to 6.14 trips per dwelling unit for the single-family land use and the weekday trip rates for both paseo homes and patio homes residential land uses were updated to 5.92 trips per dwelling unit. The project-specific trip generation rates were calculated in the Transportation Impact Study based on traffic volumes collected at similar developments in the project vicinity and in consideration of the project site proximity to employment, services, public transportation, and bicycle and pedestrian facilities. CalEEMod default mobile source data, including temperature, trip characteristics, variable start information, emission factors, and trip distances, were used for the model inputs. Operational emissions were modeled in CalEEMod under the assumption that the project would be fully operational by 2023.

Electrical Generation

The estimation of operational energy emissions was based on CalEEMod land use defaults and number of dwelling units included as a part of the project. Annual natural gas (non-hearth) and electricity emissions were estimated in CalEEMod using the emissions factors for Sacramento Municipal Utility District as a conservative estimate and adjusted to account for achievement of the 33% renewable portfolio standard by 2020. As previously discussed, RPS requires energy providers to derive 33% of their electricity from qualified renewable sources by 2020. The project would also be required to comply with the 2016 California Building Energy Efficiency Standards (Title 24, Part 6, of the California Code of Regulations).

Area Sources

CalEEMod was used to estimate GHG emissions from the project site area sources, which include gasoline-powered landscape maintenance equipment.

Water Supply and Wastewater

Water supplied to the project requires the use of electricity. Accordingly, the supply, conveyance, treatment, and distribution of water would indirectly result in GHG emissions through use of electricity. The CalEEMod modeling assumes that the project would install use of low-flow water fixtures and other water-saving devices as stated within Chapter 3, Project Description.

Solid Waste

Additionally, the project would generate solid waste and would therefore result in GHG emissions associated with landfill off-gassing. The CalEEMod modeling assumes that the project would meet AB 341 and the City's goal identified in Measure 6-1A of the GGRP to reduce solid waste generation in 2020 to 75% below 2005 levels.

The estimated operational project-generated GHG emissions for landscape maintenance, energy usage, motor vehicles, solid waste generation, water supply, and wastewater treatment, and the estimated per capita GHG emissions are shown in Table 4.8-4. Based on the total emissions of 1,768.27 MT CO_2E and the project's estimated population of 663 residents, the project is expected to generate approximately 2.7 MT CO_2E per capita.

Table 4.8-4
Estimated Annual Operational Greenhouse Gas Emissions

Emission Source	Emissions (MT CO_2E per year)
Area	4.50
Energy	667.62
Mobile	1,044.87
Solid Waste	20.00
Water Supply and Wastewater	31.28
Amortized Construction Emissions	56.07
Total Emissions	**1,824.34**
Emissions Per Capita	**2.75**

Source: Appendix E
Notes: Project emissions include compliance with 2016 Title 24 standards, meeting 33% RPS, incorporation of low-flow water fixtures, and meeting the City goal of a 75% solid waste diversion rate.
CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2E = carbon dioxide equivalent

The emissions estimates shown in Table 4.8-4 reflect the project-specific trip generation rates as discussed in Section 4.5, Transportation and Circulation, as well as quantification of several of the proposed design features incorporated in the project that contribute to minimizing the project's GHG emissions. The project would develop an infill site adjacent to the Sunrise MarketPlace, which is a major employment center in the City. Additionally, the project would develop bicycle and pedestrian facilities that would extend the existing non-motorized transportation network in the vicinity, and there is a transit center bus stop (which allows passengers to transfer between bus routes) 450 feet from the project site's southern boundary. The project design features that would help reduce GHG emissions attributed to the project include:

- Constructing each residential unit to be pre-plumbed and structurally engineered for the future installation of a complete solar energy system.

- Providing each residential unit with a tankless water heating system, a whole house ceiling fan, and "Energy Star" appliances (stoves, dishwashers, and any other appliances typically included within the initial installation by the builder).
- Providing each residential unit with an energy efficient air conditioning unit(s) that exceeds the Seasonal Energy Efficiency Ratio by a minimum of two points at the time of building permit issuance.
- Providing each residential unit with programmable thermostat timers.
- Providing each residential unit with exterior outlets to allow the use of electrically-powered landscape equipment.
- Include wiring for at least one electric car charging station in each garage.
- Use of low-flow water fixtures such as low-flow toilets, faucets, showers, etc., in each residence.
- Use of energy efficient lighting for all street, parking, and area lighting associated with the project, including all on-site and off-site lighting.

As shown in Table 4.8-4, the proposed project would result in approximately 1,768.27 MT CO_2E per year from project operations at full buildout. Based on the City's average persons per household, the project is expected to support approximately 663 residents. This results in per capita annual emissions of 2.7 MT CO_2E. With the addition of the amortized annual construction emissions of 56.07 MT CO_2E, the project's total annual emissions would be 1,824.34 MT CO_2E, resulting in per capita annual emissions of 2.75 MT CO_2E.

This is substantially below the City's targeted per capita annual GHG emissions of 4.4 MT CO_2E, as determined based on the GHG emissions projections in the GGRP (City of Citrus Heights 2011a) and the population projections in the General Plan (City of Citrus Heights 2011b). To ensure that project construction is consistent with the CalEEMod modeling assumptions and this analysis, Mitigation Measure 4.8a stipulates that the City and applicant must ensure that the proposed GHG reduction measures are incorporated in project construction.

The Citrus Heights General Plan EIR found that the statewide per capita GHG emissions in 2020 under the Scoping Plan GHG reduction targets would correlate to 6.35 MT CO_2E/person/yr and 4.36 MT CO_2E per service population (which considers residential population as well as employment) per year. The General Plan EIR also projected that at buildout of the General Plan in 2035, the City's annual per capita GHG emissions would be 4.65 MT CO_2E per resident and 3.52 MT CO_2E per service population. With annual GHG emissions of 2.75 MT CO_2E per resident, the project would be consistent with the General Plan EIR projections. The General Plan EIR concluded that "by meeting these AB 32-derived GHG efficiency targets, the City can demonstrate that the increment of new growth anticipated in the Draft General Plan in 2035 would occur in a

manner that would not hinder statewide achievement of fair share GHG reductions and would not conflict with the Scoping Plan, and could therefore be considered less than significant."

The proposed project would require a change to the general plan land use designation for the site, and thus could represent growth that was not specifically anticipated under the General Plan. However, as discussed in Section 4.2 Population and Housing, the City has not grown at the projected rate since adoption of the General Plan. The average annual growth rate between 2010 and 2017 was 0.6% (DOF 2017). Between 2013 and 2017, a total of 79 dwelling units were constructed (City of Citrus Heights 2018). Buildout of the City is expected to generate approximately 3,577 new residential dwelling units by 2035, and a population increase of approximately 15,880 people (18%) from 2010 to 2035 (City of Citrus Heights 2011a). The total population of the City with implementation of the proposed project would remain below the 2020 population projection. Thus, while the project would increase the total GHG emissions within the City compared to existing conditions, the emissions would be consistent with the projected GHG emissions for the City under the GGRP and under the General Plan EIR. Therefore, the project's greenhouse gas emissions would remain below the level that could result in a significant impact on the environment. With implementation of Mitigation Measure 4.8a, which would ensure that GHG emissions from the project are reduced to the extent reflected in the CalEEMod modeling relied on for this analysis, the impacts from both project construction and operation would not be cumulatively considerable and impacts would remain **less than significant.**

IMPACT 4.8-2:	Conflict with the City of Citrus Heights GGRP
SIGNIFICANCE:	Potentially Significant
MITIGATION MEASURE:	Mitigation Measure 4.8a
SIGNIFICANCE AFTER MITIGATION:	Less Than Significant

As a part of the August 2011 General Plan update, the City adopted a GGRP, which is a long-range plan to reduce GHG emissions from municipal operations and community activities within the City, and would also prepare the City for adapting to the impending effects of climate change. The City is committed to reducing community-wide GHG emissions by 10% to 15% below 2005 levels by 2020, consistent with AB 32 GHG emission reduction goals. In order to reduce citywide GHG emissions, the GGRP identifies a series of GHG reduction measures, which guides the City in six areas (land use and community design; transportation and connectivity; energy efficiency and conservation; water efficiency and conservation; waste reduction and diversion; and green infrastructure, public health and safety). Many of the measures outlined within the GGRP would not be directly applicable to the project, but are rather intended for the City to implement. The project proposes to develop an infill site that is close to employment, services, and public transportation, and proposes to extend the existing bicycle and

pedestrian network. With these characteristics, the project would support the City in implementing Measure 3-1A, which calls for use of smart-growth principles to reduce vehicle miles traveled, as well as Measures 3-1B, 3-5A, and 3-5B, which call for improving bicycle and pedestrian infrastructure. Additional measures applicable to the project include providing infrastructure to promote use of low-carbon and alternative fuel vehicles, conformance with Title 24 energy efficiency standards for new construction, maximizing solar access for new buildings, reducing urban water demand by 20%, and diversion of solid waste from landfills. The project would meet 2016 Title 24 standards, provide outlets for charging electric vehicles, and would incorporate use of low-flow water fixtures. For solid waste, the project would comply with the 75% waste diversion consistent with the City's goal and AB 341. As discussed above, the CalEEMod modeling for the proposed project estimates that the project would generate 1,768,27 MT CO_2E annually, assuming implementation of Mitigation Measure 4.8a. With a population of 663 residents, the project would result in annual emissions of 2.7 MT CO_2E per capita. This is substantially below the projected citywide GHG emissions rate of 4.4 MT CO_2E per capita, which was calculated based on the GHG emissions projections in the GGRP (City of Citrus Heights 2011a) and the population projections in the General Plan (City of Citrus Heights 2011b). Therefore, with implementation of Mitigation Measure 4.8a, the project would have a **less-than-significant** impact related to conflicts with the City's GGRP.

The SACOG MTP/SCS is a regional growth-management strategy that targets reducing per capita GHG emissions associated with use of passenger vehicles and light-duty trucks in the Sacramento region. The MTP/SCS incorporates population growth and local land use forecasts and contains regional transportation system improvements including the following: active transportation (non-motorized transportation—biking and walking); transportation demand management; transportation system management; transit; passenger and high-speed rail; goods movement; aviation and airport ground access; highways; arterials; and operations and maintenance. The MTP/SCS is not directly applicable to the project because the underlying purpose of the MTP/SCS is to provide direction and guidance by making the best transportation and land use choices for future development, though the project would support the goals and policies of the MTP/SCS. As discussed in Section 4.2, the project would not introduce substantial population growth that is not accounted for under the City's General Plan or MTP/SCS. Further, the project site is an infill site located close to the City's major employment centers and with good access to public transit. The project would also extend the non-motorized transportation network in the vicinity by striping bike lanes on Arcadia Drive and constructing a public multi-use trail through the project site.

The project would require changes to the general plan and zoning designations to accommodate medium density residential and open space as the project proposes. As addressed within the City's General Plan, the housing goal for 2013 to 2021 is to develop 696 new housing units with an annual need of approximately 87 units per year. The City was projected to exceed these

expectations with a projected annual development of approximately 112 new housing units. Therefore, the project would meet the City's housing needs goal by developing 260 new housing units, less than the 2013 to 2021 goal of 696 new housing units specified in the General Plan. Therefore, the project would be consistent with the regional growth forecasts in the MTP/SCS.

CARB has addressed statewide progress with regard to both the 2030 and 2050 goals for California. It states in the First Update to the Scoping Plan that "California is on track to meet the near-term 2020 GHG emissions limit and is well positioned to maintain and continue reductions beyond 2020 as required by AB 32" (CARB 2014). With regard to the 2050 target for reducing GHG emissions to 80% below 1990 levels, the First Update states the following:

> This level of reduction is achievable in California. In fact, if California realizes the expected benefits of existing policy goals (such as 12,000 megawatts of renewable distributed generation by 2020, net zero energy homes after 2020, existing building retrofits under AB 758, and others) it could reduce emissions by 2030 to levels squarely in line with those needed in the developed world and to stay on track to reduce emissions to 80% below 1990 levels by 2050. Additional measures, including locally driven measures and those necessary to meet federal air quality standards in 2032, could lead to even greater emission reductions (CARB 2014).

In other words, CARB believes that the state is on a trajectory to meet the 2030 and 2050 GHG reduction targets set forth in AB 32, EO B-30-15, and EO S-3-05. This is confirmed in the 2030 Scoping Plan, which states:

> The Proposed Plan builds upon the successful framework established by the Initial Scoping Plan and First Update, while also identifying new, technologically feasibility and cost-effective strategies to ensure that California meets its GHG reduction targets in a way that promotes and rewards innovation, continues to foster economic growth, and delivers improvements to the environment and public health, including in disadvantaged communities. The Proposed Plan is developed to be consistent with requirements set forth in AB 32, SB 32, and AB 197 (CARB 2017c).

The City's GGRP includes sufficient GHG reduction measures to ensure that the City will meet its fair share responsibility to achieve GHG reductions consistent with the Scoping Plan and in support of maintaining statewide trajectory towards meeting the 2030 and 2050 GHG reduction targets. With implementation of Mitigation Measure 4.8a, the project would not conflict with any plans adopted with the purpose of reducing GHG emissions; therefore, the project's

contribution to any conflicts with state, regional, and local GHG reduction plan would not be cumulatively considerable, and the impact would have **be less than significant**.

4.8.4 Mitigation Measures

Mitigation Measure 4.8a The City shall ensure that the following project design features are reflected in building plans prior to the issuance of building permits and shall inspect each unit to ensure these features have been implemented correctly prior to issuance of a certificate of occupancy for each unit:

- Each residential unit shall be pre-plumbed and structurally engineered for the future installation of a complete solar energy system.
- Each residential unit shall include a tankless water heating system, a whole house ceiling fan, and "Energy Star" appliances (stoves, dishwashers, and any other appliances typically included within the initial installation by the builder).
- Each residential unit shall include an energy efficient air conditioning unit(s) that exceeds the Seasonal Energy Efficiency Ratio by a minimum of two points at the time of building permit issuance.
- Each residential unit shall include programmable thermostat timers.
- Each residential unit shall include 110 volt exterior outlets to allow the use of electrically-powered landscape equipment.
- Include wiring for at least one electric car charging station in each garage.
- Prior to the issuance of a Building Permit, the floor plans and/or exterior elevations submitted in conjunction with the Building Permit application for each residence shall only utilize low-flow water fixtures such as low-flow toilets, faucets, showers, etc.
- Prior to approval of Improvement Plans the applicant shall use LED lighting (or other lighting types that are similarly energy-efficient) for all street, parking, trail, and area lighting associated with the project.

4.8.5 References

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