# 3.7 - Greenhouse Gas Emissions

## 3.7.1 - Introduction

This section describes the existing greenhouse gas (GHG) emissions setting as well as the relevant regulatory framework. This section also evaluates the possible impacts related to GHG emissions that could result from implementation of the project. Information in this section is based on project-specific GHG emissions modeling outputs included in Appendix B. No comments were received during the Environmental Impact Report (EIR) scoping period related to GHG emissions.

## 3.7.2 - Environmental Setting

### Greenhouse Effect, Global Warming, and Climate Change

Most of the energy that affects the Earth's climate comes from the sun. Some solar radiation is absorbed by the Earth's surface, and a smaller portion of this radiation is reflected by the atmosphere back toward space. As the Earth absorbs high-frequency solar radiation, its surface gains heat and then re-radiates lower frequency infrared radiation back into the atmosphere.[1]

Most solar radiation passes through gases in the atmosphere classified as GHGs; however, infrared radiation is selectively absorbed by GHGs. GHGs in the atmosphere play a critical role in maintaining the balance between the Earth's absorbed and radiated energy, the Earth's radiation budget,[2] by trapping some of the infrared radiation emitted from the Earth's surface that otherwise would have escaped to space (Figure 3.7-1). Radiative forcing is the difference between the incoming energy and outgoing energy.[3] Specifically, GHGs affect the radiative forcing of the atmosphere,[4] which in turn affects the Earth's average surface temperature. This phenomenon, the *greenhouse effect*, keeps the Earth's atmosphere near the surface warmer than it would be otherwise and allows successful habitation by humans and other forms of life.

Combustion of fossil fuels and deforestation release carbon into the atmosphere that historically has been stored underground in sediments or in surface vegetation, thus exchanging carbon from the geosphere and biosphere to the atmosphere in the carbon cycle. With the accelerated increase in fossil fuel combustion and deforestation since the Industrial Revolution of the 19$^{th}$ century, concentrations of GHGs in the atmosphere have increased exponentially. Such emissions of GHGs in excess of natural ambient concentrations contribute to the enhancement of the natural greenhouse effect. This enhanced greenhouse effect has contributed to *global warming*, an increased rate of warming of the Earth's average surface temperature.[5] Specifically, increases in GHGs lead to increased absorption of infrared radiation by the Earth's atmosphere and warm the lower atmosphere further, thereby increasing temperatures and evaporation rates near the surface.

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1 Frequencies at which bodies emit radiation are proportional to temperature. The Earth has a much lower temperature than the sun and emits radiation at a lower frequency (longer wavelength) than the high frequency (short-wavelength) solar radiation emitted by the sun.

2 This includes all gains of incoming energy and all losses of outgoing energy; the planet is always striving to be in equilibrium.

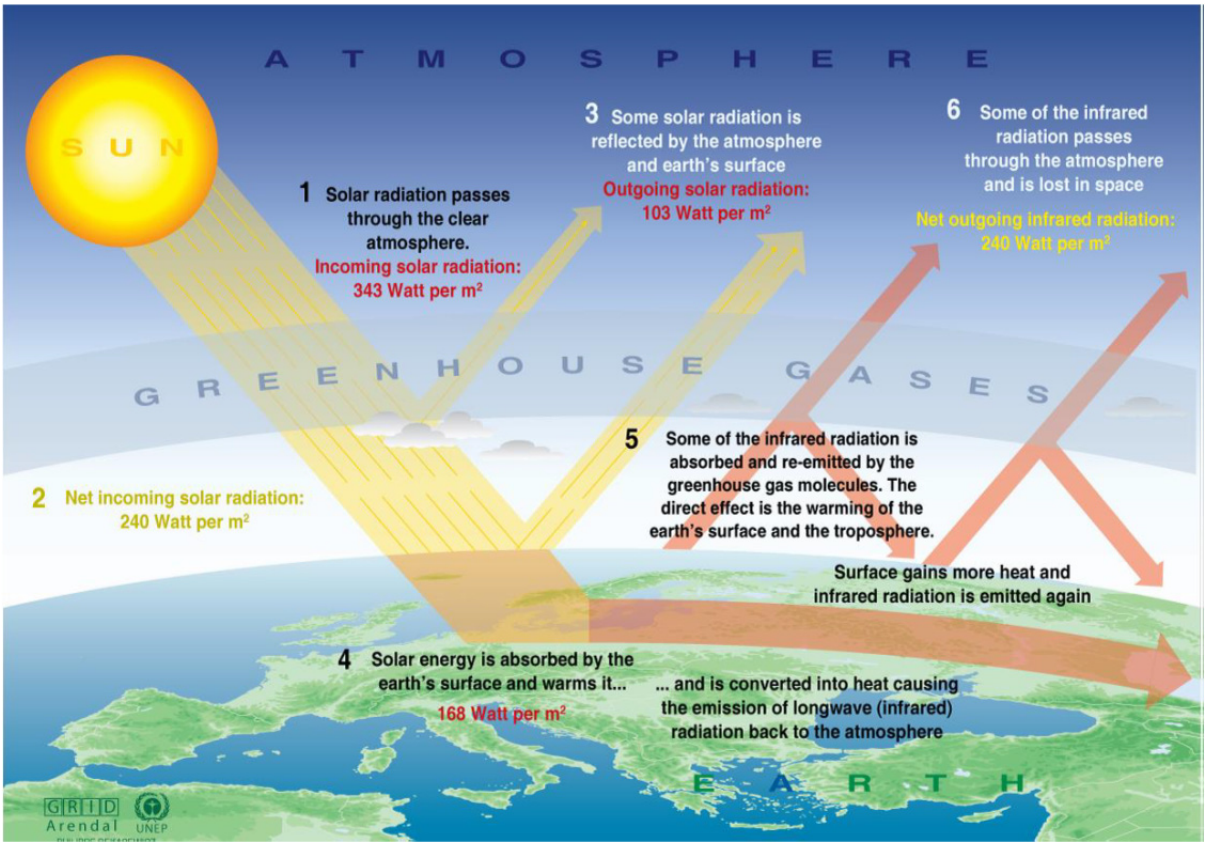
3 Positive forcing tends to warm the surface while negative forcing tends to cool it.

4 This is the change in net irradiance at the tropopause after allowing stratospheric temperatures to readjust to radiative equilibrium, but with surface and tropospheric temperatures and state held fixed at the unperturbed values.

5 This condition results when the Earth has to work harder to maintain its radiation budget, because when more GHGs are present in the atmosphere, the Earth must force emissions of additional infrared radiation out into the atmosphere.

Variations in natural phenomena, such as volcanoes and solar activity, produced most of the global temperature increase that occurred during preindustrial times; more recently, however, increasing atmospheric GHG concentrations resulting from human activity have been responsible for most of the observed global temperature increase.[6]

**Figure 3.7-1: The Greenhouse Effect**




Source: United Nations Environmental Program (UNEP)/GRID-Arendal, 2005[7]

Global warming affects global atmospheric circulation and temperatures; oceanic circulation and temperatures; wind and weather patterns; average sea level; ocean acidification; chemical reaction rates; precipitation rates, timing, and form; snowmelt timing and runoff flow; water supply; wildfire risks; and other phenomena, in a manner commonly referred to as *climate change*. Climate change is a change in the average weather of the Earth that is measured by alterations in wind patterns, storms, precipitation, and temperature. These changes are assessed using historical records of temperature changes occurring in the past, such as during previous ice ages. Many of the concerns regarding climate change use this data to extrapolate a level of statistical significance specifically focusing on temperature records from the last 150 years (the Industrial Age) that differ from previous climate changes in rate and magnitude.

[6] These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries. Since 2007, no scientific body of national or international standing has maintained a dissenting opinion.

[7] United Nations Environmental Program (UNEP)/GRID-Arendal (UNEP/GRID-Arendal). 2005. GRID-Arendal Annual Report. Website: https://cld.bz/bookdata/tRoONat/basic-html/page-1.html. Accessed June 2, 2018.

## Temperature Predictions by the Intergovernmental Panel on Climate Change

The United Nations Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation. The IPCC constructed several emission trajectories of GHGs needed to stabilize global temperatures and climate change impacts. In its Fourth Assessment Report, the IPCC predicted that the global mean temperature change from 1990 to 2100, given six scenarios, could range from 1.1 degrees Celsius (°C) to 6.4°C. Regardless of analytical methodology, global average temperatures and sea levels are expected to rise under all scenarios.[8] The report also concluded that "[w]arming of the climate system is unequivocal," and that "[m]ost of the observed increase in global average temperatures since the mid-20$^{th}$ century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations." Warming of the climate system is now considered to be unequivocal (IPCC 2007),[9] with the global surface temperature increasing approximately 1.33 degrees Fahrenheit (°F) over the last 100 years. The IPCC predicts increases in global average temperature of between 2°F and 11°F over the next 100 years, depending on the scenario.[10]

## GHGs and Global Emission Sources

Gases that trap heat in the atmosphere are referred to as GHGs. The effect is analogous to the way a greenhouse retains heat. Prominent GHGs that naturally occur in the Earth's atmosphere are water vapor, carbon dioxide ($CO_2$), methane ($CH_4$), oxides of nitrogen ($NO_X$), and ozone. Anthropogenic (human-caused) GHG emissions include releases of these GHGs plus release of human-made gases with high global warming potential (GWP) (ozone-depleting substances such as chlorofluorocarbons [CFCs][11] and aerosols, hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride ($SF_6$). The GHGs listed by the IPCC ($CO_2$, methane, nitrous oxide, HFCs, PFCs, and $SF_6$) are discussed below, in order of abundance in the atmosphere. Water vapor, despite being the most abundant GHG, is not discussed below because natural concentrations and fluctuations far outweigh anthropogenic influences, making it impossible to predict. Ozone is not included because it does not directly affect radiative forcing. Ozone-depleting substances, which include chlorofluorocarbons, halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons, are not included because they have been primarily replaced by HFCs and PFCs.

[8] Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Website: www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html. Accessed June 15, 2017.

[9] Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Website: www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html. Accessed June 15, 2017.

[10] Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Website: www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html. Accessed June 15, 2017.

[11] CFCs destroy stratospheric ozone. The Montreal Protocol on Substances that Deplete the Ozone Layer prohibited CFCs production in 1987.

The global warming potential is the potential of a gas or aerosol to trap heat in the atmosphere. The global warming potential of a gas is essentially a measurement of the radiative forcing of a GHG compared with the reference gas, $CO_2$.

Individual GHG compounds have varying potential for contributing to global warming. For example, methane is 25 times as potent as $CO_2$, while $SF_6$ is 22,200 times more potent than $CO_2$ on a molecule-per-molecule basis. To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method for comparing GHG emissions is the GWP methodology defined in the IPCC reference documents.[12] The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of carbon dioxide equivalents ($CO_2e$), which compares the gas in question to that of the same mass of $CO_2$ (by definition, $CO_2$ has a GWP of 1). The global warming potential of a GHG is a measure of how much a given mass of a GHG is estimated to contribute to global warming. Thus, to describe how much global warming a given type and amount of GHG may cause, the $CO_2e$ is used. A $CO_2e$ is the mass emissions of an individual GHG multiplied by its global warming potential. As such, a high GWP represents high absorption of infrared radiation and a long atmospheric lifetime compared to $CO_2$. One must also select a time horizon to convert GHG emissions to equivalent $CO_2$ emissions to account for chemical reactivity and lifetime differences among various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons (MT) of $CO_2e$ (MT $CO_2e$) emitted per year.

The atmospheric residence time of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal.[13] The atmospheric residence time of a gas is, in effect, a half-life measurement of the length of time a gas is expected to persist in the atmosphere when accounting for removal mechanisms such as chemical transformation and deposition.

Table 3.7-1 lists the GWP of each GHG and its lifetime. Units commonly used to describe the concentration of GHGs in the atmosphere are parts per million (ppm), parts per billion (ppb), and parts per trillion (ppt), referring to the number of molecules of the GHG in a sampling of 1 million, 1 billion, or 1 trillion molecules of air. Collectively, HFCs, PFCs, and $SF_6$ are referred to as high-GWP gases. $CO_2$ is by far the largest component of worldwide $CO_2e$ emissions, followed by methane, nitrous oxide, and high-GWP gases, in order of decreasing contribution to $CO_2e$.

The primary human processes that release GHGs include the burning of fossil fuels for transportation, heating, and electricity generation; agricultural practices that release methane, such as livestock grazing and crop residue decomposition; and industrial processes that release smaller amounts of high-GWP gases. Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove $CO_2$ from the air and altering the Earth's albedo or surface reflectance, thus allowing more solar radiation to be absorbed. Specifically, $CO_2$ emissions associated with fossil fuel combustion are the primary contributors to

[12] Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Website: www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html. Accessed June 15, 2017.

[13] Seinfeld, J.H. and Pandis, S.N. 2006. Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, 2nd Edition. New York. John Wiley & Sons.

human-induced climate change. $CO_2$, methane, and nitrous oxide emissions associated with human activities are the next largest contributors to climate change.

GHGs of California concern are defined by California Assembly Bill (AB) 32 (see the Regulatory Environment subsection below for a description) and include $CO_2$, $CH_4$, $NO_X$, HFCs, PFCs, and $SF_6$. A seventh GHG, nitrogen trifluoride ($NF_3$), was also added under the California Health and Safety Code section 38505(g)(7) as a GHG of concern. These GHGs are described in terms of their physical description and properties, global warming potential, atmospheric residence lifetime, sources, and atmospheric concentration in 2005 in Table 3.7-1.

**Table 3.7-1: Description of GHGs of California Concern**

| GHG | Physical Description and Properties | Global Warming Potential (100 years) | Atmospheric Residence Lifetime (years) | Sources |
|---|---|---|---|---|
| Carbon dioxide ($CO_2$) | Odorless, colorless, natural gas. | 1 | 50–200 | burning coal, oil, natural gas, and wood; decomposition of dead organic matter; respiration of bacteria, plants, animals, and fungus; oceanic evaporation; volcanic outgassing; cement production; land use changes |
| Methane ($CH_4$) | Flammable gas and is the main component of natural gas. | 25 | 12 | geological deposits (natural gas fields) extraction; landfills; fermentation of manure; and decay of organic matter |
| Nitrous oxide ($N_2O$) | Nitrous oxide (laughing gas) is a colorless GHG. | 298 | 114 | microbial processes in soil and water; fuel combustion; industrial processes |
| Chloro-fluoro-carbons (CFCs) | Nontoxic, nonflammable, insoluble, and chemically unreactive in the troposphere (level of air at the Earth's surface); formed synthetically by replacing all hydrogen atoms in methane or ethane with chlorine and/or fluorine atoms. | 3,800-8,100 | 45–640 | refrigerants aerosol propellants; cleaning solvents. |
| Hydro-fluoro-carbons (HFCs) | Synthetic human-made chemicals used as a substitute for CFCs and contain carbon, chlorine, and at least one hydrogen atom. | 140 to 11,700 | 1–50,000 | automobile air conditioners; refrigerants |

## Table 3.7-1 (cont.): Description of GHGs of California Concern

| GHG | Physical Description and Properties | Global Warming Potential (100 years) | Atmospheric Residence Lifetime (years) | Sources |
|---|---|---|---|---|
| Per-fluoro-carbons (PFCs) | Stable molecular structures and only break down by ultraviolet rays about 60 kilometers above Earth's surface. | 6,500 to 9,200 | 10,000–50,000 | primary aluminum production; semiconductor manufacturing |
| Sulfur hexafluoride ($SF_6$) | Human-made, inorganic, odorless, colorless, and nontoxic, nonflammable gas. | 22,800 | 3,200 | electrical power transmission equipment insulation; magnesium industry, semiconductor manufacturing; a tracer gas |
| Nitrogen trifluoride ($NF_3$) | Inorganic, is used as a replacement for PFCs, and is a powerful oxidizing agent. | 17,200 | 740 | electronics manufacture for semiconductors and liquid crystal displays. |

Sources:
Intergovernmental Panel on Climate Change (IPCC). 2007a. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, Website: www.ipcc.ch /publications_and_data/ar4/wg1/en/contents.html. Accessed June 5, 2018.

Intergovernmental Panel on Climate Change (IPCC). 2007b. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Core Writing Team, Pachauri, R.K. and Reisinger, A. [eds.]). IPCC, Geneva, Switzerland. Website: www.ipcc.ch /publications_and_data/ar4/syr/en/contents.html. Accessed June 5, 2018.

The State has begun the process of addressing pollutants referred to as short-lived climate pollutants. Senate Bill (SB) 605, approved by the Governor on September 14, 2014 required the California Air Resources Board (ARB) to complete a comprehensive strategy to reduce emissions of short-lived climate pollutants by January 1, 2016. The ARB released the Proposed Short-Lived Climate Pollutant Reduction Strategy in April 2016. The ARB has completed an emission inventory of these pollutants, identified research needs, identified existing and potential new control measures that offer co-benefits, and coordinated with other state agencies and districts to develop measures.

The short-lived climate pollutants include three main components: black carbon, fluorinated gases, and methane. Fluorinated gases and methane are described in Table 3.7-1 and are already included in the California GHG inventory. Black carbon has not been included in past GHG inventories; however, the ARB will include it in its comprehensive strategy.[14]

[14] California Air Resources Board (ARB). 2015c. Short-Lived Climate Pollutant Reduction Strategy, Concept Paper. May. Website: http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf. Accessed June 3, 2017.

Black carbon is a component of fine particulate matter. Black carbon is formed by incomplete combustion of fossil fuels, biofuels, and biomass. Sources of black carbon within a jurisdiction may include exhaust from diesel trucks, vehicles, and equipment, as well as smoke from biogenic combustion. Biogenic combustion sources of black carbon include the burning of biofuels used for transportation, the burning of biomass for electricity generation and heating, prescribed burning of agricultural residue, and natural and unnatural wildfires. Black carbon is not a gas but an aerosol—particles or liquid droplets suspended in air. Black carbon only remains in the atmosphere for days to weeks, whereas other GHGs can remain in the atmosphere for years. Black carbon can be deposited on snow, where it absorbs sunlight, reduces sunlight reflectivity, and hastens snowmelt. Direct effects include absorbing incoming and outgoing radiation; indirectly, black carbon can also affect cloud reflectivity, precipitation, and surface dimming (cooling).

Global warming potentials for black carbon were not defined by the IPCC in its Fourth Assessment Report. The ARB has identified a global warming potential of 3,200 using a 20-year time horizon and 900 using a 100-year time horizon from the IPCC Fifth Assessment. Sources of black carbon are already regulated by the ARB, and air district criteria pollutant and toxic regulations that control fine particulate emissions from diesel engines and other combustion sources.[15] Additional controls on the sources of black carbon specifically for their GHG impacts beyond those required for toxic and fine particulates are not likely to be needed.

Ozone is another short-lived climate pollutant that will be part of the strategy. Ozone affects evaporation rates, cloud formation, and precipitation levels. Ozone is not directly emitted, so its precursor emissions, volatile organic compounds (VOC) and $NO_X$ on a regional scale and $CH_4$ on a hemispheric scale will be subject of the strategy.[16]

Water vapor is also considered a GHG. Water vapor is an important component of our climate system and is not regulated. Increasing water vapor leads to warmer temperatures, which causes more water vapor to be absorbed into the air. Warming and water absorption increase in a spiraling cycle. Water vapor feedback can also amplify the warming effect of other GHGs, such that the warming brought about by increased carbon dioxide allows more water vapor to enter the atmosphere.[17]

## Introduction to Global Climate Change

Global climate change is defined as the change in average meteorological conditions on Earth with respect to temperature, precipitation, and storms. Global temperatures are regulated by naturally occurring atmospheric gases such as water vapor, $CO_2$, $N_2O$, $CH_4$, hydrofluorocarbons, perfluorocarbons and $SF_6$. These particular gases are important because of their residence time (duration they stay) in the atmosphere, which ranges from 10 years to more than 100 years. These gases allow solar radiation into the Earth's atmosphere, but prevent radioactive heat from escaping, thus warming the Earth's atmosphere. Global climate change can occur naturally, as it has in the past with the previous ice ages.

[15] California Air Resources Board (ARB). 2015c. Short-Lived Climate Pollutant Reduction Strategy, Concept Paper. May. Website: http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf. Accessed June 3, 2017.

[16] California Air Resources Board (ARB). 2015c. Short-Lived Climate Pollutant Reduction Strategy, Concept Paper. May. Website: http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf. Accessed June 3, 2017.

[17] National Aeronautics and Space Administration (NASA). 2015. NASA—Global Climate Change, Vital Signs of a Planet. Website: http://climate.nasa.gov/causes/. Accessed August 21, 2016.

According to the ARB, the climate change since the industrial revolution differs from previous climate changes in both rate and magnitude.

Gases that trap heat in the atmosphere are often referred to as GHGs. GHGs are released into the atmosphere by both natural and anthropogenic (human) activity. Without the natural greenhouse effect, the Earth's average temperature would be approximately 61°F cooler than it is currently. The cumulative accumulation of these gases in the Earth's atmosphere is considered the cause for the observed increase in the Earth's temperature.

Although California's rate of growth of GHG emissions is slowing, the State is still a substantial contributor to the U.S. emissions inventory total. In 2004, California is estimated to have produced 492 million metric tons (MMT) of carbon dioxide equivalents (MMT $CO_2e$) GHG emissions. Despite a population increase of 16 percent between 1990 and 2004, California has significantly slowed the rate of growth of GHG emissions because of the implementation of energy efficiency programs as well as adoption of strict emission controls.

## Global Climate Change Issue

Climate change is a global problem because GHGs are global pollutants, unlike criteria air pollutants and hazardous air pollutants (also called toxic air contaminants), which are pollutants of regional and local concern. Pollutants with localized air quality effects have relatively short atmospheric lifetimes, approximately 1 day; by contrast, GHGs have long atmospheric lifetimes, several years to several thousand years. GHGs persist in the atmosphere for a long enough time to be dispersed around the globe.

Although the exact lifetime of any particular GHG molecule depends on multiple variables and cannot be pinpointed, more $CO_2$ is currently emitted into the atmosphere than is sequestered. $CO_2$ sinks, or reservoirs, include vegetation and the ocean, which absorb $CO_2$ through photosynthesis and dissolution, respectively. These are two of the most common processes of $CO_2$ sequestration. Of the total annual human-caused $CO_2$ emissions, approximately 54 percent is sequestered through ocean uptake, Northern Hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused $CO_2$ emissions is stored in the atmosphere.[18]

Similarly, effects of GHGs are borne globally, as opposed to the localized air quality effects of criteria air pollutants and hazardous air pollutants. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known and cannot be quantified, and no single project would be expected to measurably contribute to a noticeable incremental change in the global average temperature, or to global or local climates or microclimate.

Emissions of GHGs have the potential to adversely affect the environment because such emissions contribute, on a cumulative basis, to global climate change. A cumulative discussion and analysis of project impacts on global climate change is presented in this EIR because, although it is unlikely that

[18] Seinfeld, J. H. and Pandis, S. N. 1998. Atmospheric Chemistry and Physics from Air Pollution to Climate Change. New York. John Wiley & Sons.

a single project will contribute significantly to climate change, cumulative emissions from many projects affect global GHG concentrations and the climate system.

Global climate change has the potential to result in sea level rise (resulting in flooding of low-lying areas), to affect rainfall and snowfall (leading to changes in water supply), to affect temperatures and habitats (affecting biological resources and public health), and to result in many other adverse environmental consequences.

Although the international, national, State, and regional communities are beginning to address GHGs and the potential effects of climate change, worldwide GHG emissions will likely continue to rise over the next decades.

## Climate and Topography

Climate is the accumulation of daily and seasonal weather events over a long interval, whereas weather is defined as the condition of the atmosphere at any particular time and place. For a detailed discussion of existing regional and project site climate and topography, see Section 3.2, Air Quality.

## Existing GHG Emissions

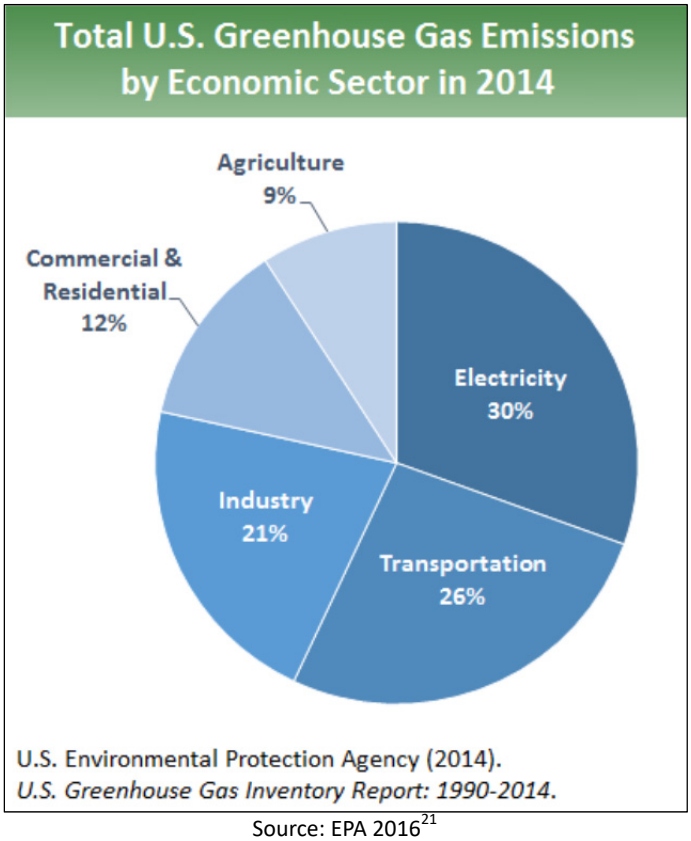
### *U.S. GHG Inventory*

Total U.S. GHG emissions were approximately 1 percent higher in 2014 than in 2013.[19] Figure 3.7-2 presents 2014 U.S. GHG emissions by economic sector. Total U.S. GHG emissions increased by 7.4 percent from 1990 to 2014 (from 6,233.2 MMT $CO_2e$ in 1990 to 6,870.5 MMT $CO_2e$ in 2014). Since 1990, U.S. emissions have increased at an average annual rate of 0.3 percent. In 2014, cool winter conditions led to an increase in $CO_2e$ emissions associated with fuels used for heating in the residential and commercial sectors. Transportation emissions also increased because of a small increase in vehicle miles traveled. There was also an increase in industrial production across multiple sectors, resulting in slight increases in industrial-sector emissions.[20]

[19] United States Environmental Protection Agency (EPA). 2016. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014. EPA 430-R-16-002. Website: https://www.epa.gov/sites/production/files/2017-04/documents/us-ghg-inventory-2016-main-text.pdf. Accessed June 2, 2018.

[20] *Ibid*.

**Figure 3.7-2: 2014 U.S. GHG Emissions by Sector**




Source: EPA 2016[21]
Note: Emissions shown do not include carbon sinks such as change in land uses and forestry.

### *California GHG Inventory*

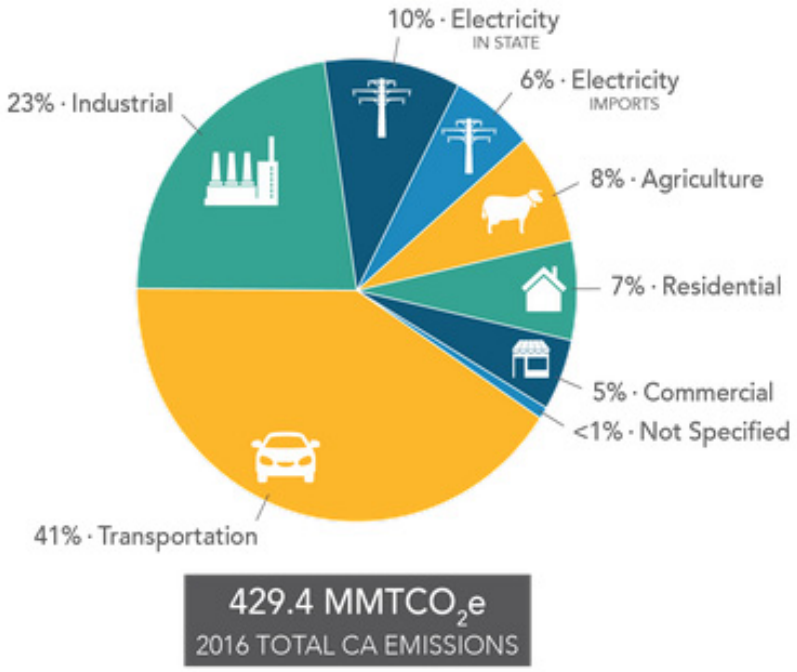
As the second largest emitter of GHGs in the U.S. and the 12th to 16th largest GHG emissions emitter in the world, California contributes a large quantity (429.24 MMT $CO_2e$ in 2016) of GHG emissions to the atmosphere.[22] Emissions of $CO_2$ are byproducts of fossil-fuel combustion and are attributable in large part to human activities associated with transportation, industry/manufacturing, electricity and natural gas consumption, and agriculture. In California, the transportation sector is the largest emitter at 41 percent of GHG emissions, followed by industry/manufacturing at 23 percent of GHG emissions (Figure 3.7-3).[23]

[21] United States Environmental Protection Agency (EPA). 2016. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014. EPA 430-R-16-002. Website: https://www.epa.gov/sites/production/files/2017-04/documents/us-ghg-inventory-2016-main-text.pdf. Accessed June 2, 2018.

[22] California Climate Change Center. (CCCC). 2006. Our Changing Climate, Assessing the Risks to California: A Summary Report from the California Climate Change Center. July 2006. CEC-500-2006-077. Website: www.scc.ca.gov/webmaster/ftp/pdf/climate_change/assessing_risks.pdf. Accessed June 2, 2018.

[23] California Air Resources Board (ARB). 2017. California Greenhouse Inventory-Graphs. Website: https://www.arb.ca.gov/cc/inventory/data/graph/graph.htm. Accessed June 5, 2018.

**Figure 3.7-3: 2016 California GHG Emissions by Sector**




Sources: ARB 2018[24]

### *Bay Area Air Quality Management District GHG Inventory*

The Bay Area Air Quality Management District (BAAQMD) published a GHG inventory for the San Francisco Bay Area (Bay Area), which provides an estimate of GHG emissions in the base year 2011 for all counties located in the jurisdiction of BAAQMD: Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Napa, and the southern portions of Solano and Sonoma counties.[25] This GHG inventory is based on the standards for criteria pollutant inventories and is intended to support BAAQMD's climate protection activities.

Table 3.7-2 shows the 2011 breakdown of emissions by end-use sector for each county within BAAQMD's jurisdiction. The estimated GHG emissions are presented in $CO_2e$, which weights each GHG by its GWP. The GWPs used in the BAAQMD inventory are from the Second Assessment Report of the IPCC.

In 2011, GHG emissions from the Contra Costa County accounted for approximately 31 percent of the Bay Area's total GHG emissions with 17.8 percent of the Bay Area's total GHG emissions coming from the industrial/commercial land uses in Contra Costa County.[26] Transportation is the largest

[24] California Air Resources Board (ARB). 2018. California Greenhouse Inventory-Graphs. Website: https://www.arb.ca.gov/cc/inventory/data/graph/graph.htm. Accessed March 19, 2019.

[25] Bay Area Air Quality Management District (BAAQMD). 2015. Bay Area Emissions Inventory Summary Report: Greenhouse Gases Base Year 2011. January. Website: http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf. Accessed June 5, 2018.

[26] Bay Area Air Quality Management District (BAAQMD). 2015. Bay Area Emissions Inventory Summary Report: Greenhouse Gases Base Year 2011. January. Website: http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory /by2011_ghgsummary.pdf. Accessed June 5, 2018.

GHG emissions sector in the Bay Area, followed by industrial/commercial, electricity generation and cogeneration, and residential fuel usage. In Contra Costa County, the largest amount of GHG emissions are generated by the industrial/commercial sector, followed by the electricity/Co-generation sector.

**Table 3.7-2: 2011 County GHG Emissions by Sector (million metric tons $CO_2e$/Year)**

| Sector | Alameda | Contra Costa | Marin | Napa | San Francisco | San Mateo | Santa Clara | Solano* | Sonoma* |
|---|---|---|---|---|---|---|---|---|---|
| Industrial/Commercial | 2.7 | 17.8 | 0.4 | 0.2 | 1.2 | 1.4 | 4.1 | 2.7 | 0.5 |
| Residential Fuel | 1.3 | 1.0 | 0.3 | 0.1 | 0.9 | 0.8 | 1.5 | 0.3 | 0.4 |
| Electricity/Co-gen. | 0.9 | 7.2 | 0.1 | 0.1 | 0.5 | 0.4 | 2.2 | 0.4 | 0.2 |
| Off-Road Equipment | 0.2 | 0.2 | 0.0 | 0.0 | 0.2 | 0.1 | 0.4 | 0.0 | 0. |
| Transportation | 7.9 | 5.0 | 1.3 | 0.9 | 3.0 | 5.0 | 7.6 | 1.6 | 2.0 |
| Agriculture/Farming | 0.1 | 0.2 | 0.2 | 0.1 | 0.0 | 0.0 | 0.2 | 0.1 | 0.2 |
| **Total** | **13.2** | **31.4** | **2.4** | **1.5** | **5.7** | **7.7** | **16.0** | **5.1** | **3.5** |

Notes:
* Portion within BAAQMD jurisdiction
BAAQMD = Bay Area Air Quality Management District; $CO_2e$ = carbon dioxide equivalent; co-gen = cogeneration
Source: Bay Area Air Quality Management District (BAAQMD). 2015. Bay Area Emissions Inventory Summary Report: Greenhouse Gases Base Year 2011. January. Website: http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf. Accessed June 5, 2018.

### *Contra Costa County*

A community-wide baseline (2005) GHG emissions inventory was conducted for Contra Costa County as part of the development of the Climate Action Plan (CAP).[27] Table 3.7-3 provides the estimated 2005 baseline by sector for Contra Costa County.

**Table 3.7-3: 2005 Unincorporated County GHG Emissions Baseline by Sector (excluding Stationary Source Emissions)**

| Sector | Metric Tons $CO_2e$/Year | Percentage of Total |
|---|---|---|
| Residential Energy | 274,690 | 20 |
| Nonresidential Energy | 118,770 | 8 |
| Solid Waste | 48,450 | 3 |
| Landfill | 193,950 | 14 |
| On-road Transportation | 628,200 | 45 |
| Off-Road Equipment | 71,880 | 5 |
| Water and Wastewater | 8,080 | 1 |

[27] Contra Costa County. 2015. Contra Costa County CAP. December 15. Website: http://www.co.contra-costa.ca.us/4554/Climate-Action-Plan. Accessed February 25, 2019.

**Table 3.7-3 (cont.): 2005 Unincorporated County GHG Emissions Baseline by Sector (excluding Stationary Source Emissions)**

| Sector | Metric Tons $CO_2e$/Year | Percentage of Total |
|---|---|---|
| BART | 2,300 | <1 |
| Agriculture | 57,320 | 4 |
| Total | 1,403,610 | 100 |
| Source: Contra Costa County CAP, December 2015. | | |

### *Project Site*

The project site is occupied by two existing residential buildings that would generate GHG emissions from sources such as vehicle trips and typical residential uses of energy, water, and waste. Consistent with the project-specific transportation impact assessment, the baseline vehicle trips and associated emissions were assumed to be zero. As such, GHG emissions were not quantified for the two existing residential buildings.

## Climate Change Trends and Effects

$CO_2$ accounts for more than 75 percent of all anthropogenic GHG emissions, the atmospheric residence time of $CO_2$ is decades to centuries, and global atmospheric concentrations of $CO_2$ continue to increase at a faster rate than ever previously recorded. Thus, the warming impacts of $CO_2$ will persist for hundreds of years after mitigation is implemented to reduce GHG concentrations.

### *California*

Substantially higher temperatures, more extreme wildfires, and rising sea levels are just some of the direct effects experienced in California.[28,29] As reported by the California Natural Resources Agency in 2009, despite annual variations in weather patterns, California has seen a trend of increased average temperatures, more extreme hot days, fewer cold nights, longer growing seasons, less winter snow, and earlier snowmelt and rainwater runoff. Statewide average temperatures increased by about 1.7°F from 1895 to 2011, and a larger proportion of total precipitation is falling as rain instead of snow.[30] Sea level rose by as much as seven inches along the California coast over the last century, leading to increased erosion and adding pressure to the State's infrastructure, water supplies, and natural resources.

These observed trends in California's climate are projected to continue in the future. Research indicates that California will experience overall hotter and drier conditions with a continued

[28] California Natural Resources Agency (CNRA). 2009. 2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. Website: http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf. Accessed June 5, 2018.

[29] California Energy Commission (CEC). 2012. Our Changing Climate 2012: Vulnerability & Adaptation to the Increasing Risks from Climate Change in California. Website: http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf. Accessed June 5, 2018.

[30] California Energy Commission (CEC). 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. Draft Final Report. CEC-600-2006-013-D. Website: http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-D.PDF. Accessed June 5, 2018.

reduction in winter snow (with concurrent increases in winter rains), as well as increased average temperatures and accelerating sea level rise. The frequency, intensity, and duration of extreme weather events such as heat waves, wildfires, droughts, and floods will also change.[31] In addition, increased air pollution and spread of insects potentially carrying infectious diseases will also occur as the climate-associated temperature and associated species clines shift in latitude.

The following is a summary of climate change factors and predicted trends specific to California.

In California, climate change may result in consequences such as the following.[32,33]

- **A reduction in the quality and supply of water from the Sierra snowpack.** If heat-trapping emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. This can lead to challenges in securing adequate water supplies. It can also lead to a potential reduction in hydropower.
- **Increased risk of large wildfires.** If rain increases as temperatures rise, wildfires in the grasslands and chaparral ecosystems of southern California are estimated to increase by approximately 30 percent toward the end of the 21st century because more winter rain will stimulate the growth of more plant "fuel" available to burn in the fall. In contrast, a hotter, drier climate could promote up to 90 percent more northern California fires by the end of the century by drying out and increasing the flammability of forest vegetation.
- **Reductions in the quality and quantity of certain agricultural products.** The crops and products likely to be adversely affected include wine grapes, fruit, nuts, and milk.
- **Exacerbation of air quality problems.** If temperatures rise to the medium warming range, there could be 75 to 85 percent more days with weather conducive to ozone formation in Los Angeles and the San Joaquin Valley, relative to today's conditions. This is more than twice the increase expected if rising temperatures remain in the lower warming range. This increase in air quality problems could result in an increase in asthma and other health-related problems.
- **A rise in sea levels resulting in the displacement of coastal businesses and residences.** During the past century, sea levels along California's coast have risen about seven inches. If emissions continue unabated and temperatures rise into the higher anticipated warming range, sea level is expected to rise an additional 22 to 35 inches by the end of the century. Elevations of this magnitude would inundate coastal areas with salt water, accelerate coastal erosion, threaten vital levees and inland water systems, and disrupt wetlands and natural habitats.

[31] California Natural Resources Agency (CNRA). 2009. 2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. Website: http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf. Accessed June 5, 2018.

[32] California Climate Change Center. (CCCC). 2006. Our Changing Climate, Assessing the Risks to California: A Summary Report from the California Climate Change Center. July 2006. CEC-500-2006-077. Website: www.scc.ca.gov/webmaster/ftp/pdf/climate_change/assessing_risks.pdf. Accessed August 17, 2015.

[33] Moser et al. 2009. Moser, Susie, Guido Franco, Sarah Pittiglio, Wendy Chou, Dan Cayan. 2009. The Future Is Now: An Update on Climate Change Science Impacts and Response Options for California. California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-500-2008-071. Website: www.energy.ca.gov/2008publications/CEC-500-2008-071/CEC-500-2008-071.PDF. Accessed May 7, 2013.

- **An increase temperature and extreme weather events.** Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in California. More heat waves can exacerbate chronic disease or heat-related illness.
- **A decrease in the health and productivity of California's forests.** Climate change can cause an increase in wildfires, an enhanced insect population, and establishment of non-native species.

### *Bay Area*

The following is a summary of climate change factors and predicted trends specific to the Bay Area.

*Temperature, Heat, Drought, and Wildfire Events*

The Bay Area is expected to experience warming over the rest of the 21st century. Consistent with statewide projections, the annual average temperature in the Bay Area will likely increase by 2.7°F between 2000 and 2050, based on GHGs that have already been emitted into the atmosphere. By the end of the century, the increase in the Bay Area's annual average temperature may range from approximately 3.5°F to 11°F relative to the average annual temperature simulated for the 1961–1990 baseline period used for the study, depending on the GHG emissions scenarios.[34] The projected rate of warming, especially in the latter half of the 21st century, is considerably greater than warming rates derived from historical observed data.

Specific predictions related to temperature/heat are summarized below.

- The annual average temperature in the Bay Area has been increasing over the last several decades.
- The Bay Area is expected to see an increase in average annual temperature of 2.7°F by 2050, and 3.5°F to 11°F by 2100. Projections show a greater warming trend during the summer season. The coastal parts of the Bay Area will experience the most moderate warming trends.[35]
- Extreme heat events are expected to increase in duration, frequency, and severity by 2050. Extreme freeze events are expected to decrease in frequency and severity by 2100, but occasional colder-than-historical events may occur by 2050.[36]

*Precipitation, Rainfall, and Flooding Events*

Studies of the effect of climate change on the long-term average precipitation for California show some disagreement.[37] Considerable variability exists across individual models, and examining the average changes can mask more extreme scenarios that project much wetter or drier conditions. California is expected to maintain a Mediterranean climate through the next century, with dry summers and wet

[34] California Climate Change Center (CCCC). 2009. Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment. Final Paper. CEC-500-2009-014-F. Website: http://www.energy.ca.gov/2009publications /CEC-500-2009-014/CEC-500-2009-014-F.PDF. Accessed June 5, 2018.
[35] Cal-Adapt. 2014. Climate Tools. Website: http://cal-adapt.org/tools/. Accessed 2014.
[36] *Ibid*.
[37] California Climate Change Center (CCCC). 2009. Climate Change Scenarios and Sea Level Rise Estimates for the California 2009. Climate Change Scenarios Assessment. Final Paper. CEC-500-2009-014-F. Website: http://www.energy.ca.gov/2009publications/ CEC-500-2009-014/CEC-500-2009-014-F.PDF. Accessed June 5, 2018.

winters that vary between seasons, years, and decades. Wetter winters and drier springs are also expected, but overall annual precipitation is not projected to change substantially. By mid-century, more precipitation is projected to occur in winter in the form of less frequent but larger events. The majority of global climate models predict drying trends across the State by 2100.[38]

Specific factors related to precipitation/rainfall/extreme events are summarized below.

- The Bay Area has not experienced substantial changes in rainfall depth or intensities over the past 30 years.
- The Bay Area will continue to experience a Mediterranean climate, with little change in annual precipitation projected by 2050, although a high degree of variability may persist.
- An annual drying trend is projected to occur by 2100. The greatest decline in precipitation is expected to occur during the spring months, while minimal change is expected during the winter months.
- Increases in drought duration and frequency coupled with higher temperatures, as experienced in 2012, 2013, and 2014, will increase the likelihood of wildfires.
- California is expected to see increases in the magnitude of extreme events, including increased precipitation delivered from atmospheric river events, which would bring high levels of rainfall during short time periods and increase the chance of flash floods. The Bay Area is also expected to see an increase in precipitation intensities, but possibly through less frequent events.[39]

*Reduced Sierra Nevada Snowpack and Water Supply Shortages*

If heat-trapping emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. This can lead to challenges in securing adequate surface water supplies.

*Vectors and Disease Events*

Climate change will likely increase the vectors of insects and, in turn, may increase the risk of some infectious diseases, particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects, such as malaria, dengue fever, yellow fever, and encephalitis.

*Air Quality and Pollution Events*

Respiratory disorders will be exacerbated by warming-induced increases in the frequency of smog (ground-level ozone) events and particulate air pollution.[40] Although there could be health effects resulting from changes in the climate and the consequences that can occur, inhalation of GHGs at levels currently in the atmosphere would not result in adverse health effects, with the exception of

[38] California Natural Resources Agency (CNRA). 2009. 2009 California Climate Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. Website: http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf. Accessed June 5, 2018.

[39] California Climate Change Center (CCCC). 2009. Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment. Final Paper. CEC-500-2009-014-F. Website: http://www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-F.PDF. Accessed June 5, 2018.

[40] United States Environmental Protection Agency (EPA). 2009. Ozone and your Health. EPA-456/F-09-001. Website: http://www.epa.gov/airnow/ozone-c.pdf. Accessed August 21, 2016.

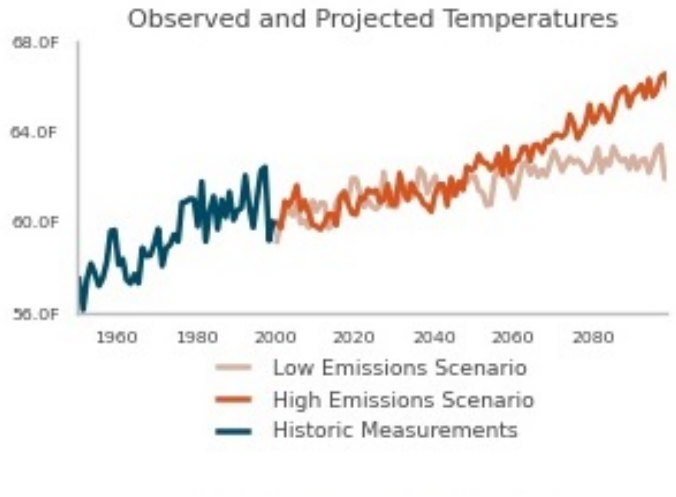
ozone and aerosols (particulate matter). The potential health effects of ozone and particulate matter are discussed in criteria pollutant analyses. At very high indoor concentrations (not at levels existing outside), carbon dioxide, methane, $SF_6$, and some chlorofluorocarbons can cause suffocation as the gases can displace oxygen.[41,42]

### *Contra Costa County*

*Temperature and Heat*

Figure 3.7-4 displays a chart of measured historical (i.e., observed) and projected annual average temperatures in the Contra Costa County area. As shown in the figure, temperatures are expected to rise as part of both the low and high GHG emissions scenarios.[43] The results indicate that temperatures are predicted to increase by 3.3°F under the low emission scenario and 5.7°F under the high emissions scenario.[44]

**Figure 3.7-4: Observed and Projected Temperatures in Contra Costa County**




Source: CalAdapt 2019[45]

*Drought and Wildfires*

Fire hazards present a considerable problem to vegetation and wildlife habitats throughout Contra Costa County. Grassland fires are easily ignited, particularly in dry seasons. (See Section 3.8, Hazards, Hazardous Materials, and Wildfire, for a more detailed discussion related to wildfire hazard areas and wildfire-conducive conditions.) The potential for increased temperatures and drought conditions due to climate change would result in increased risk from wildfire in these areas.

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41 Centers for Disease Control and Prevention (CDC). 2010. Department of Health and Human Services, the National Institute for Occupational Safety and Health. Carbon Dioxide. Website: www.cdc.gov/niosh/npg/npgd0103.html. Accessed February 14, 2017.

42 Occupational Safety and Health Administration (OSHA). 2003. United States Department of Labor. Safety and Health Topics: Methane. Website: www.osha.gov/dts/chemicalsampling/data/CH_250700.html. Accessed August 21, 2016.

43 The low and high GHG emissions scenarios are based on IPCC's Special Report on Emissions Scenarios B1 and A1, respectively. The higher global GHG emissions scenario (A1) assumes a global trend of rapid economic growth. The lower GHG emissions scenario (B1) assumes the same global population as in the A1 storyline but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. Overall, the B1 scenario places more focus on global environmental sustainability rather than rapid economic growth.

44 CalAdapt. 2019. Local Climate Snapshots. Website: http://cal-adapt.org/tools/factsheet/. Accessed March 19, 2019.

45 *Ibid*.

*Reduced Sierra Nevada Snowpack and Water Supply Shortages*

As described in Section 3.17, Utilities and Service Systems, Contra Costa County receives potable water from the Contra Costa Water District (CCWD), which pumps water from four intakes in the San Joaquin Delta. The CCWD's water source is provided by the Central Valley Project (CVP), which receives water from storage releases from Shasta, Folsom, and Clair Eagle reservoirs into the Sacramento River in the San Joaquin Delta.[46] Originating in the Sierra Nevada Mountains, water flows into the Sacramento and San Joaquin Rivers into the Delta where it is drawn and transported via Contra Costa Canal. The availability of surface water supply could decline if climate change results in reduced snowpack in the Sierra Nevada.

### *Project Site*

The project site is located within an urban area with limited vegetative fuel-load and no steep hillside conditions that are not conducive to wildfires. However, there are hilly, vegetated areas located in the vicinity of the project site that have a higher risk for wildfires. The closest hilly, vegetated areas are located approximately 2.5 miles northwest of the project site. The potential for increased temperatures and drought conditions due to climate change would result in increased risk from wildfire in those areas, as well as increased risk related to water supply shortage.

## 3.7.3 - Regulatory Framework

### International

#### *Kyoto Protocol*

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing GHG emissions at average of five percent against 1990 levels over the five-year period from 2008–2012. The Convention (as discussed above) encouraged industrialized countries to stabilize emissions; however, the Protocol commits them to do so. Developed countries have contributed more emissions over the last 150 years; therefore, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

In 2001, President George W. Bush indicated that he would not submit the treaty to the U.S. Senate for ratification, which effectively ended American involvement in the Kyoto Protocol. In December 2009, international leaders met in Copenhagen to address the future of international climate change commitments post-Kyoto. No binding agreement was reached in Copenhagen; however, the Committee identified the long-term goal of limiting the maximum global average temperature increase to no more than 2°C above pre-industrial levels, subject to a review in 2015. The Climate Change Committee held additional meetings in Durban, South Africa in November 2011; Doha, Qatar in November 2012; and Warsaw, Poland in November 2013. The meetings are gradually gaining consensus among participants on individual climate change issues.

[46] United States Bureau of Reclamation. 2019. Central Valley Project (CVP) Mid-Pacific Region. Website: https://www.usbr.gov/mp/cvp/. Accessed March 19, 2019.

On September 23, 2014, more than 100 heads of state and government, and leaders from the private sector and civil society met at the Climate Summit in New York hosted by the United Nations. At the Summit, heads of government, business and civil society announced actions in areas that would have the greatest impact on reducing emissions, including climate finance, energy, transport, industry, agriculture, cities, forests, and building resilience.

### *United Nations Climate Change Framework Convention*

On March 21, 1994, the United States joined a number of countries around the world in signing the United Nations Climate Change Framework Convention. Under the Convention, governments agreed to gather and share information on GHG emissions, national policies, and best practices; launch national strategies for addressing GHG emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of climate change.

### *Paris Climate Change Agreement*

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a landmark agreement on December 12 in Paris, charting a fundamentally new course in the two-decade-old global climate effort. Culminating a 4-year negotiating round, the new treaty ends the strict differentiation between developed and developing countries that characterized earlier efforts, replacing it with a common framework that commits all countries to put forward their best efforts and to strengthen them in the years ahead. This includes, for the first time, requirements that all parties report regularly on their emissions and implementation efforts, and undergo international review.

The agreement and a companion decision by parties were the key outcomes of the conference, known as the 21st Session of the UNFCCC Conference of the Parties, or "COP 21." Together, the Paris Agreement and the accompanying COP decision:

- Reaffirm the goal of limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees;
- Establish binding commitments by all parties to make "nationally determined contributions" (NDCs), and to pursue domestic measures aimed at achieving them;
- Commit all countries to report regularly on their emissions and "progress made in implementing and achieving" their NDCs, and to undergo international review;
- Commit all countries to submit new NDCs every 5 years, with the clear expectation that they will "represent a progression" beyond previous ones;
- Reaffirm the binding obligations of developed countries under the UNFCCC to support the efforts of developing countries, while for the first time encouraging voluntary contributions by developing countries too;
- Extend the current goal of mobilizing $100 billion a year in support by 2020 through 2025, with a new, higher goal to be set for the period after 2025;

- Extend a mechanism to address "loss and damage" resulting from climate change, which explicitly will not "involve or provide a basis for any liability or compensation;"
- Require parties engaging in international emissions trading to avoid "double counting;" and
- Call for a new mechanism, similar to the Clean Development Mechanism under the Kyoto Protocol, enabling emission reductions in one country to be counted toward another country's NDC.[47]

On June 1, 2017, President Trump announced the decision for the United States to withdraw from the Paris Climate Accord.[48] California remains committed to combating climate change through programs aimed to reduce GHGs.[49]

## Continental

### *Western Climate Initiative (Western North America Cap-and-Trade Program)*

Cap-and-trade refers to a policy tool where emissions are limited to a certain amount and can be traded, or provides flexibility on how the emitter can comply. Each emitter caps carbon dioxide emissions from power plants, auctions carbon dioxide emission allowances, and invests the proceeds in strategic energy programs that further reduce emissions, save consumers money, create jobs, and build a clean energy economy. The Western Climate Initiative partner jurisdictions have developed a comprehensive initiative to reduce North America GHG emissions to 15 percent below 2005 levels by 2020. The partners are California, British Columbia, Manitoba, Ontario, and Quebec. Currently only California and Quebec are participating in the cap-and-trade program.[50]

## Federal

### *Clean Air Act*

Coinciding with the 2009 meeting in Copenhagen, on December 7, 2009, the United States Environmental Protection Agency (EPA) issued an Endangerment Finding under Section 202(a) of the Clean Air Act, opening the door to federal regulation of GHGs. The Endangerment Finding notes that GHGs threaten public health and welfare and are subject to regulation under the Clean Air Act. To date, the EPA has not promulgated regulations on GHG emissions, but it has already begun to develop them.

Previously the EPA had not regulated GHGs under the Clean Air Act, because it asserted that the Act did not authorize it to issue mandatory regulations to address global climate change and that such regulation would be unwise without an unequivocally established causal link between GHGs and the increase in global surface air temperatures. In Massachusetts v. Environmental Protection Agency et al. (127 S. Ct. 1438 (2007), however, the U.S. Supreme Court held that GHGs are pollutants under the

[47] Center for Climate and Energy Solutions (C2ES). 2015a. Outcomes of the U.N. Climate Change Conference. Website: http://www.c2es.org/international/negotiations/cop21-paris/summary. Accessed April 19, 2016.

[48] The White House. Statement by President Trump on the Paris Climate Accord. Website: https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord. Accessed June 23, 2017.

[49] California Air Resources Board (ARB). 2017. New Release: California and China Team Up to Push for Millions More Zero-emission Vehicles. Website: https://www.arb.ca.gov/newsreel/newsrelease.php?id=934. Accessed June 27, 2017.

[50] Center for Climate and Energy Solutions (C2ES). 2015b. Multi-State Climate Initiatives. Website: http://www.c2es.org/us-states-regions/regional-climate-initiatives. Accessed July 12, 2018.

Clean Air Act and directed the EPA to decide whether the gases endangered public health or welfare (see discussion below).

The EPA had also not moved aggressively to regulate GHGs because it expected Congress to make progress on GHG legislation, primarily from the standpoint of a cap-and-trade system. However, proposals circulated in both the House of Representatives and the Senate have been controversial and it may be some time before the U.S. Congress adopts major climate change legislation. The EPA's Endangerment Finding paves the way for federal regulation of GHGs with or without Congress.

### *U.S. Clean Air Act Permitting Programs (New GHG Source Review)*

The EPA issued a final rule on May 13, 2010, that establishes thresholds for GHGs that define when permits under the New Source Review Prevention of Significant Deterioration and Title V Operating Permit programs are required for new and existing industrial facilities. This final rule "tailors" the requirements of these Clean Air Act permitting programs to limit which facilities will be required to obtain Prevention of Significant Deterioration and Title V permits. In the preamble to the revisions to the federal code of regulations, the EPA states:

> This rulemaking is necessary because without it the Prevention of Significant Deterioration and Title V requirements would apply, as of January 2, 2011, at the 100 or 250 tons per year levels provided under the Clean Air Act, greatly increasing the number of required permits, imposing undue costs on small sources, overwhelming the resources of permitting authorities, and severely impairing the functioning of the programs. EPA is relieving these resource burdens by phasing in the applicability of these programs to greenhouse gas sources, starting with the largest greenhouse gas emitters. This rule establishes two initial steps of the phase-in. The rule also commits the agency to take certain actions on future steps addressing smaller sources, but excludes certain smaller sources from Prevention of Significant Deterioration and Title V permitting for greenhouse gas emissions until at least April 30, 2016.

The EPA estimates that facilities responsible for nearly 70 percent of the national GHG emissions from stationary sources will be subject to permitting requirements under this rule. This includes the nation's largest GHG emitters—power plants, refineries, and cement production facilities.

### *Energy Independence and Security Act*

The Energy Policy Act of 2005 created the Renewable Fuel Standard program. The Energy Independence and Security Act of 2007 expanded this program by:

- Expanding the Renewable Fuel Standard program to include diesel in addition to gasoline;
- Increasing the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022;
- Establishing new categories of renewable fuel, and setting separate volume requirements for each one; and
- Requiring the EPA to apply life-cycle GHG performance threshold standards to ensure that each category of renewable fuel emits fewer GHGs than the petroleum fuel it replaces.

This expanded Renewable Fuel Standard program lays the foundation for achieving substantial reductions of GHG emissions from the use of renewable fuels, reducing the use of imported petroleum, and encouraging the development and expansion of the nation's renewable-fuels sector.

Signed on December 19, 2007, by the President, the Energy Independence and Security Act (EISA) of 2007 aims to:

- move the United States toward greater energy independence and security;
- increase the production of clean renewable fuels;
- protect consumers;
- increase the efficiency of products, buildings, and vehicles;
- promote research on and deploy GHG capture and storage options;
- improve the energy performance of the Federal Government; and
- increase U.S. energy security, develop renewable fuel production, and improve vehicle fuel economy.

EISA reinforces the energy reduction goals for federal agencies put forth in Executive Order 13423, as well as introduces more aggressive requirements. The three key provisions enacted are the Corporate Average Fuel Economy Standards, the Renewable Fuel Standard, and the appliance/lighting efficiency standards.

The EPA is committed to developing, implementing, and revising both regulations and voluntary programs under the following subtitles in EISA, among others:

- Increased Corporate Average Fuel Economy Standards
- Federal Vehicle Fleets
- Renewable Fuel Standard
- Biofuels Infrastructure
- Carbon Capture and Sequestration[51]

### *The EPA and National Highway Traffic Safety Administration Light-Duty Vehicle GHG Emission Standards and Corporate Average Fuel Economy Standards Final Rule*

Congress first passed the Corporate Average Fuel Economy law in 1975 to increase the fuel economy of cars and light duty trucks. The law has become more stringent over time. On May 19, 2009, the President put in motion a new national policy to increase fuel economy for all new cars and trucks sold in the United States. On April 1, 2010, the EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced a joint final rule establishing a national program that would reduce GHG emissions and improve fuel economy for new cars and trucks sold in the United States.

The first phase of the national program would apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. They require these

[51] United States Environmental Protection Agency (EPA). Summary of the Energy Independence and Security Act. Website: https://www.epa.gov/laws-regulations/summary-energy-independence-and-security-act

vehicles to meet an estimated combined average emissions level of 250 grams of $CO_2$ per mile, 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 would cut $CO_2$ emissions by an estimated 960 million metric tons and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program (model years 2012-2016).

The EPA and the NHTSA issued final rules on a second-phase joint rulemaking, establishing national standards for light-duty vehicles for model years 2017 through 2025 in August 2012.[52] The new standards for model years 2017 through 2025 apply to passenger cars, light-duty trucks, and medium duty passenger vehicles. The final standards are projected to result in an average industry fleet wide level of 163 grams/mile of $CO_2$ in model year 2025, which is equivalent to 54.5 miles per gallon (mpg) if achieved exclusively through fuel economy improvements.

The EPA and NHTSA issued final rules for the first national standards to reduce GHG emissions and improve fuel efficiency of heavy-duty trucks and buses on September 15, 2011, which became effective November 14, 2011. For combination tractors, the agencies are proposing engine and vehicle standards that began in the 2014 model year and achieve up to a 20-percent reduction in $CO_2$ emissions and fuel consumption by the 2018 model year. For heavy-duty pickup trucks and vans, the agencies are proposing separate gasoline and diesel truck standards, which phase in starting in the 2014 model year and achieve up to a 10-percent reduction for gasoline vehicles, and a 15-percent reduction for diesel vehicles by 2018 model year (12 and 17 percent respectively if accounting for air conditioning leakage). Lastly, for vocational vehicles, the engine and vehicle standards would achieve up to a 10-percent reduction in fuel consumption and $CO_2$ emissions from the 2014 to 2018 model years.

The State of California has received a waiver from the EPA to have separate, stricter corporate average fuel economy standards. Although global climate change did not become an international concern until the 1980s, efforts to reduce energy consumption began in California in response to the oil crisis in the 1970s, resulting in the incidental reduction of GHG emissions. In order to manage the State's energy needs and promote energy efficiency, AB 1575 created the California Energy Commission (CEC) in 1975.

### *Massachusetts et al. v. EPA (U.S. Supreme Court GHG Endangerment Ruling)*

*Massachusetts et al. v. EPA* (Supreme Court Case 05-1120) was argued before the United States Supreme Court on November 29, 2006, in which it was petitioned that the EPA regulate four GHGs, including $CO_2$, under Section 202(a)(1) of the Clean Air Act (CAA). A decision was made on April 2, 2007, in which the Supreme Court found that GHGs are air pollutants covered by the CAA. The Court held that the Administrator must determine whether 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 EPA Administrator signed two distinct findings regarding GHGs under section 202(a) of the CAA:

[52] United States Environmental Protection Agency (EPA). 2012. The EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017-2025 Cars and Light Trucks. Website: http://www.epa.gov/otaq/climate/documents/420f12051.pdf. Accessed August 21, 2016.

- **Endangerment Finding:** The Administrator finds that the current and projected concentrations of the six key well-mixed GHGs—$CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$—in the atmosphere threaten the public health and welfare of current and future generations; and
- **Cause or Contribute Finding:** The Administrator finds 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.

These findings do not impose requirements on industry or other entities. However, this was a prerequisite for implementing GHG emissions standards for vehicles, as discussed under "Clean Vehicles" below. After a lengthy legal challenge, the U.S. Supreme Court declined to review an Appeals Court ruling upholding that upheld the EPA Administrator findings.

### *U.S. Consolidated Appropriations Act (Mandatory GHG Reporting)*

The Consolidated Appropriations Act of 2008, passed in December 2007, requires the establishment of mandatory GHG reporting requirements. On September 22, 2009, the EPA issued the Final Mandatory Reporting of Greenhouse Gases Rule, which became effective January 1, 2010. The rule requires reporting of GHG emissions from large sources and suppliers in the United States, and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to the EPA. The first annual reports for the largest emitting facilities, covering calendar year 2010, were submitted to the EPA in 2011.

## State

### *California AB 1493: Pavley Regulations and Fuel Efficiency Standards*

California AB 1493, enacted on July 22, 2002, required the ARB to develop and adopt regulations that reduce GHGs emitted by passenger vehicles and light duty trucks. Implementation of the regulation was delayed by lawsuits filed by automakers and by the EPA's denial of an implementation waiver. The EPA subsequently granted the requested waiver in 2009, which was upheld by the by the U.S. District Court for the District of Columbia in 2011.[53]

The standards are to be phased in during the 2009 through 2016 model years. When fully phased in, the near-term (2009–2012) standards will result in an approximately 22-percent reduction compared with the 2002 fleet, and the mid-term (2013–2016) standards will result in about a 30-percent reduction. Several technologies stand out as providing significant reductions in emissions at favorable costs. These include discrete variable valve lift or camless valve actuation to optimize valve operation rather than relying on fixed valve timing and lift as has historically been done; turbocharging to boost power and allow for engine downsizing; improved multi-speed

[53] California Air Resources Board (ARB). 2013d. Clean Car Standards—Pavley, Assembly Bill 1493. Website: http://www.arb.ca.gov/cc/ccms/ccms.htm. Accessed February 14, 2017.

transmissions; and improved air conditioning systems that operate optimally, leak less, and/or use an alternative refrigerant.[54]

The second phase of the implementation for the Pavley Bill was incorporated into Amendments to the Low-Emission Vehicle (LEV) Program referred to as LEV III or the Advanced Clean Cars program. The Advanced Clean Car program combines the control of smog-causing pollutants and GHG emissions into a single coordinated package of requirements for model years 2017 through 2025. The regulation will reduce GHGs from new cars by 34 percent from 2016 levels by 2025. The new rules will reduce pollutants from gasoline and diesel-powered cars, and deliver increasing numbers of zero-emission technologies, such as full battery electric cars, newly emerging plug-in hybrid electric vehicles and hydrogen fuel cell cars. The regulations will also ensure adequate fueling infrastructure is available for the increasing numbers of hydrogen fuel cell vehicles planned for deployment in California.[55]

### *California Executive Order S-3-05 (GHG Emissions Reduction Targets)*

Former California Governor Arnold Schwarzenegger announced on June 1, 2005, through Executive Order S-3-05, the following reduction targets for GHG emissions:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

The 2050 reduction goal represents what some scientists believe is necessary to reach levels that will stabilize the climate. The 2020 goal was established to be a mid-term target. Because this is an executive order, the goals are not legally enforceable for local governments or the private sector.

### *California AB 32: Global Warming Solutions Act and Scoping Plan*

The California State Legislature enacted AB 32, the California Global Warming Solutions Act of 2006. AB 32 requires that GHGs emitted in California be reduced to 1990 levels by the year 2020. "Greenhouse gases" as defined under AB 32 include $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$. Since AB 32 was enacted, a seventh chemical, nitrogen trifluoride, has also been added to the list of GHGs. The ARB is the State agency charged with monitoring and regulating sources of GHGs. AB 32 states the following:

> Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.

[54] California Air Resources Board (ARB). 2013e. Facts About the Clean Cars Program. Website: http://www.arb.ca.gov/msprog/zevprog/factsheets/advanced_clean_cars_eng.pdf. Accessed February 14, 2017.

[55] California Air Resources Board (ARB). 2011c. Status of Scoping Plan Recommended Measures. Website: www.arb.ca.gov/cc/scopingplan/sp_measures_implementation_timeline.pdf. Accessed February 14, 2017.

The ARB approved the 1990 GHG emissions level of 427 million metric tons of carbon dioxide equivalents (MMT $CO_2e$) on December 6, 2007.[56] Therefore, to meet the State's target, emissions generated in California in 2020 are required to be equal to or less than 427 MMT $CO_2e$. Emissions in 2020 in a Business as Usual (BAU) scenario were estimated to be 596 MMT $CO_2e$, which do not account for reductions from AB 32 regulations.[57] At that rate, a 28 percent reduction was required to achieve the 427 MMT $CO_2e$ 1990 inventory. In October 2010, the ARB prepared an updated 2020 forecast to account for the effects of the 2008 recession and slower forecasted growth. The 2020 inventory without the benefits of adopted regulation is now estimated at 545 MMT $CO_2e$. Therefore, under the updated forecast, a 21.7 percent reduction from BAU is required to achieve 1990 levels.[58]

The State has made steady progress in implementing AB 32 and achieving targets included in Executive Order S-3-05. The progress is shown in updated emission inventories prepared by the ARB for 2000 through 2012 to show progress achieved to date.[59] The State has also achieved the Executive Order S-3-05 target for 2010 of reducing GHG emissions to 2000 levels. As shown below, the 2010 emission inventory achieved this target. Also shown are the average reductions needed from all statewide sources (including all existing sources) to reduce GHG emissions back to 1990 levels.

- **1990:** 427 million MT $CO_2e$ (AB 32 2020 Target)
- **2000:** 463 million MT $CO_2e$ (an average 8-percent reduction needed to achieve 1990 base)
- **2010:** 450 million MT $CO_2e$ (an average 5-percent reduction needed to achieve 1990 base)
- **2020:** 545 million MT $CO_2e$ BAU (an average 21.7-percent reduction from BAU needed to achieve 1990 base)

The ARB Climate Change Scoping Plan (Scoping Plan) contains measures designed to reduce the State's emissions to 1990 levels by the year 2020 to comply with AB 32.[60] The Scoping Plan identifies recommended measures for multiple GHG emission sectors and the associated emission reductions needed to achieve the year 2020 emissions target—each sector has a different emission reduction target. Most of the measures target the transportation and electricity sectors. As stated in the Scoping Plan, the key elements of the strategy for achieving the 2020 GHG target include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a Statewide renewables energy mix of 33 percent;
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;

[56] California Air Resources Board (ARB). 2007. Staff Report. California 1990 Greenhouse Gas Level and 2020 Emissions Limit. November 16, 2007. Website: www.arb.ca.gov/cc/inventory/pubs/reports/staff_report_1990_level.pdf. Accessed February 14, 2017.

[57] California Air Resources Board (ARB). 2008. (includes edits made in 2009) Climate Change Scoping Plan, a framework for change. Website: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed February 14, 2017.

[58] California Air Resources Board (ARB). 2010a. 2020 Greenhouse Gas Emissions Projection and BAU Scenario Emissions Estimate. Website: http://www.arb.ca.gov/cc/inventory/archive/captrade_2010_projection.pdf. Accessed February 14, 2017.

[59] California Air Resources Board (ARB). 2014a. California Greenhouse Gas Emissions for 2000 to 2012—Trends of Emissions and Other Indicators. Website: http://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-12_report.pdf. Accessed April 25, 2016.

[60] California Air Resources Board (ARB). 2008 (includes edits made in 2009). Climate Change Scoping Plan, a framework for change. Website: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf. Accessed February 14, 2017.

- Establishing targets for transportation-related GHG emissions for regions throughout California and pursuing policies and incentives to achieve those targets;
- 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; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long-term commitment to AB 32 implementation.

In addition, the Scoping Plan differentiates between "capped" and "uncapped" strategies. Capped strategies are subject to the proposed cap-and-trade program. The Scoping Plan states that the inclusion of these emissions within the cap-and trade program will help ensure that the year 2020 emission targets are met despite some degree of uncertainty in the emission reduction estimates for any individual measure. Implementation of the capped strategies is calculated to achieve a sufficient amount of reductions by 2020 to achieve the emission target contained in AB 32. Uncapped strategies that will not be subject to the cap-and-trade emissions caps and requirements are provided as a margin of safety by accounting for additional GHG emission reductions.[61]

The ARB approved the First Update to the Scoping Plan (Update) on May 22, 2014. The Update identifies the next steps for California's climate change strategy. The Update shows how California continues on its path to meet the near-term 2020 GHG limit, but also sets a path toward long-term, deep GHG emission reductions. The report establishes a broad framework for continued emission reductions beyond 2020, on the path to 80 percent below 1990 levels by 2050. The Update identifies progress made to meet the near-term objectives of AB 32 and defines California's climate change priorities and activities Climate for the next several years. The Update does not set new targets for the State, but describes a path that would achieve the long term 2050 goal of Executive Order S-05-03 for emissions to decline to 80 percent below 1990 levels by 2050.

AB 32 does not give the ARB a legislative mandate to set a target beyond the 2020 target from AB 32 or to adopt additional regulations to achieve a post-2020 target. The Update estimates that reductions averaging 5.2 percent per year would be required after 2020 to achieve the 2050 goal. With no estimate of future reduction commitments from the State, identifying a feasible strategy including plans and measures to be adopted by local agencies is not currently possible.[62]

The Cap-and-Trade Program is a key element of the Scoping 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 program is designed to provide covered entities the flexibility to seek out and implement the lowest cost options to reduce emissions. The program conducted its first auction in November 2012. Compliance obligations began for power plants and large industrial sources in January 2013. Other significant milestones include

[61] California Air Resources Board (ARB). 2008 (includes edits made in 2009). Climate Change Scoping Plan, a framework for change. Website: http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

[62] California Air Resources Board (ARB). 2014b. First Update to the Climate Change Scoping Plan. Website: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm.

linkage to Quebec's Cap-and-Trade system in January 2014 and starting the compliance obligation for distributors of transportation fuels, natural gas, and other fuels in January 2015.[63]

The Cap-and-Trade Program provides a firm cap, ensuring that the 2020 Statewide emission limit will not be exceeded. An inherent feature of the Cap-and-Trade program is that it does not guarantee GHG emissions reductions in any discrete location or by any particular source. Rather, GHG emissions reductions are only guaranteed on an accumulative basis. As summarized by the ARB in the First Update:

> The Cap-and-Trade Regulation gives companies the flexibility to trade allowances with others or take steps to cost-effectively reduce emissions at their own facilities. Companies that emit more have to turn in more allowances or other compliance instruments. Companies that can cut their GHG emissions have to turn in fewer allowances. But as the cap declines, aggregate emissions must be reduced. In other words, a covered entity theoretically could increase its GHG emissions every year and still comply with the Cap-and-Trade Program if there is a reduction in GHG emissions from other covered entities. Such a focus on aggregate GHG emissions is considered appropriate because climate change is a global phenomenon, and the effects of GHG emissions are considered cumulative.[64]

The Cap-and-Trade Program works with other direct regulatory measures and provides an economic incentive to reduce emissions. If California's direct regulatory measures reduce GHG emissions more than expected, then the Cap-and-Trade Program will be responsible for relatively fewer emissions reductions. If California's direct regulatory measures reduce GHG emissions less than expected, then the Cap-and-Trade Program will be responsible for relatively more emissions reductions. Thus, the Cap-and-Trade Program assures that California will meet its 2020 GHG emissions reduction mandate:

> The Cap-and-Trade Program establishes an overall limit on GHG emissions from most of the California economy—the "capped sectors." Within the capped sectors, some of the reductions are being accomplished through direct regulations, such as improved building and appliance efficiency standards, the [Low Carbon Fuel Standard] LCFS, and the 33 percent [Renewables Portfolio Standard] RPS. Whatever additional reductions are needed to bring emissions within the cap is accomplished through price incentives posed by emissions allowance prices. Together, direct regulation and price incentives assure that emissions are brought down cost-effectively to the level of the overall cap. The Cap-and-Trade Regulation provides assurance that California's 2020 limit will be met because the regulation sets a firm limit on 85 percent of California's GHG emissions. In sum, the Cap-and-Trade Program will achieve aggregate, rather than site specific or project-level, GHG emissions reductions. Also, due to the regulatory architecture adopted by ARB in AB 32, the reductions attributed to the Cap-and-Trade

[63] California Air Resources Board (ARB). 2015. ARB Emissions Trading Program. Website: http://www.arb.ca.gov/cc/capandtrade/guidance/cap_trade_overview.pdf. Accessed February 14, 2017.

[64] California Air Resources Board (ARB). 2014b. First Update to the Climate Change Scoping Plan. Website: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm. Accessed February 14, 2017.

Program can change over time depending on the State's emissions forecasts and the effectiveness of direct regulatory measures.[65]

### *California Senate Bill 375: Sustainable Communities and Climate Protection Act*

SB 375 was signed into law on September 30, 2008. According to SB 375, the transportation sector is the largest contributor of GHG emissions, which emits over 40 percent of the total GHG emissions in California. SB 375 states, "Without improved land use and transportation policy, California will not be able to achieve the goals of AB 32." SB 375 does the following: (1) requires metropolitan planning organizations to include sustainable community strategies in their regional transportation plans for reducing GHG emissions, (2) aligns planning for transportation and housing, and (3) creates specified incentives for the implementation of the strategies.

Concerning California Environmental Quality Act (CEQA), SB 375, as codified in Public Resources Code Section 21159.28, states that CEQA findings determinations for certain projects are not required to reference, describe, or discuss (1) growth inducing impacts or (2) any project-specific or cumulative impacts from cars and light-duty truck trips generated by the project on global warming or the regional transportation network if the project:

1. Is in an area with an approved sustainable communities strategy or an alternative planning strategy that ARB accepts as achieving the GHG emission reduction targets;
2. Is consistent with that strategy (in designation, density, building intensity, and applicable policies); and
3. Incorporates the mitigation measures required by an applicable prior environmental document.

### *California SB 1368: Emission Performance Standards*

In 2006, the State Legislature adopted SB 1368, which was subsequently signed into law by the Governor. SB 1368 directs the California Public Utilities Commission to adopt a performance standard for GHG emissions for the future power purchases of California utilities. SB 1368 seeks to limit carbon emissions associated with electrical energy consumed in California by forbidding procurement arrangements for energy longer than 5 years from resources that exceed the emissions of a relatively clean, combined cycle natural gas power plant. Because of the carbon content of its fuel source, a coal-fired plant cannot meet this standard because such plants emit roughly twice as much carbon as natural gas, combined cycle plants. Accordingly, the new law effectively prevents California's utilities from investing in, otherwise financially supporting, or purchasing power from new coal plants located in or out of the State. The California Public Utilities Commission adopted the regulations required by SB 1368 on August 29, 2007. The regulations implementing SB 1368 establish a standard for baseload generation owned by, or under long-term contract to publicly owned utilities, of 1,100 lbs $CO_2$ per megawatt-hour (MWh).

[65] California Air Resources Board (ARB). 2014b. First Update to the Climate Change Scoping Plan. Website: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm. Accessed February 14, 2017.

### *California Executive Order S-01-07: Low Carbon Fuel Standard*

The Governor signed Executive Order S 01-07 on January 18, 2007. The order mandates that a statewide goal shall be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020. In particular, the executive order established a Low Carbon Fuel Standard (LCFS) and directed the Secretary for Environmental Protection to coordinate the actions of the CEC, ARB, the University of California, and other agencies to develop and propose protocols for measuring the "life-cycle carbon intensity" of transportation fuels. This analysis supporting development of the protocols was included in the State Implementation Plan for alternative fuels (State Alternative Fuels Plan adopted by CEC on December 24, 2007) and was submitted to the ARB for consideration as an "early action" item under AB 32. The ARB adopted the Low Carbon Fuel Standard on April 23, 2009.

The LCFC was subject to legal challenge in 2011. Ultimately, on August 8, 2013, the Fifth District Court of Appeal (California) ruled that the ARB failed to comply with CEQA and the Administrative Procedure Act when adopting regulations for Low Carbon Fuel Standards. In a partially published opinion, the Court of Appeal directed that Resolution 09-31 and two executive orders of the ARB approving LCFS regulations promulgated to reduce GHG emissions be set aside. However, the court tailored its remedy to protect the public interest by allowing the LCFS regulations to remain operative while the ARB complies with the procedural requirements it failed to satisfy.

To address the Court ruling, the ARB was required to bring a new LCFS regulation to the Board for consideration in February 2015. The proposed LCFS regulation was required to contain revisions to the 2010 LCFS as well as new provisions designed to foster investments in the production of the low-carbon fuels, offer additional flexibility to regulated parties, update critical technical information, simplify and streamline program operations, and enhance enforcement. The second public hearing for the new LCFS regulation was held on September 24, 2015 and September 25, 2015, where the LCFS Regulation was adopted. The Final Rulemaking Package adopting the regulation was filed with the Office of Administrative Law (OAL) on October 2, 2015. The OAL approved the regulation on November 16, 2015.[66]

### *California Executive Order S-13-08*

Executive Order S-13-08 states that "climate change in California during the next century is expected to shift precipitation patterns, accelerate sea level rise and increase temperatures, thereby posing a serious threat to California's economy, to the health and welfare of its population and to its natural resources." Pursuant to the requirements in the order, the 2009 California Climate Adaptation Strategy was adopted, which is the ". . . first Statewide, multi-sector, region-specific, and information-based climate change adaptation strategy in the United States." Objectives include analyzing risks of climate change in California, identifying and exploring strategies to adapt to climate change, and specifying a direction for future research.

[66] California Air Resources Board (ARB). 2015e. Low Carbon Fuel Standard Regulation. Website: http://www.arb.ca.gov/regact/2015/lcfs2015/lcfs2015.htm. Accessed September 22, 2017.

### *California SBX 7-7: Water Conservation Act*

This 2009 legislation directs urban retail water suppliers to set individual 2020 per capita water use targets and begin implementing conservation measures to achieve those goals. Meeting this statewide goal of 20 percent decrease in demand will result in a reduction of almost 2 million acre-feet in urban water use in 2020.

### *California SB 97 and the CEQA Guidelines Update*

Passed in August 2007, SB 97 added Section 21083.05 to the Public Resources Code. The Code states "(a) On or before July 1, 2009, the Office of Planning and Research shall prepare, develop, and transmit to the Resources Agency guidelines for the mitigation of GHG emissions or the effects of GHG emissions as required by this division, including, but not limited to, effects associated with transportation or energy consumption. (b) On or before January 1, 2010, the Resources Agency shall certify and adopt guidelines prepared and developed by the Office of Planning and Research pursuant to subdivision (a)."

Section 21097 was also added to the Public Resources Code, which provided an exemption until January 1, 2010 for transportation projects funded by the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 or projects funded by the Disaster Preparedness and Flood Prevention Bond Act of 2006, in stating that the failure to analyze adequately the effects of GHGs would not violate CEQA. The Natural Resources Agency completed the approval process and the Amendments became effective on March 18, 2010.

The 2010 CEQA Amendments provide guidance to public agencies regarding the analysis and mitigation of the effects of GHG emissions in CEQA documents. The CEQA Amendments fit within the existing CEQA framework by amending existing CEQA Guidelines to reference climate change.

Section 15064.4(b) of the CEQA Guidelines provides direction for lead agencies for assessing the significance of impacts of GHG emissions:

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting;
- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; or
- 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. Such regulations or requirements must be adopted by the relevant public agency through a public review process and must include specific requirements that reduce or mitigate the project's incremental contribution of GHG emissions. If there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with the adopted regulations or requirements, an EIR must be prepared for the project.

The CEQA Guidelines amendments do not identify a threshold of significance for GHG emissions, nor do they prescribe assessment methodologies or specific mitigation measures. Instead, they call for a

"good-faith effort, based on available information, to describe, calculate, or estimate the amount of greenhouse gas emissions resulting from a project." The amendments encourage lead agencies to consider many factors in performing a CEQA analysis and preserve lead agencies' discretion to make their own determinations based upon substantial evidence. The amendments also encourage public agencies to make use of programmatic mitigation plans and programs from which to tier when they perform individual project analyses.

Also amended were CEQA Guidelines Sections 15126.4 and 15130, which address mitigation measures and cumulative impacts, respectively. GHG mitigation measures are referenced in general terms, but no specific measures are championed. The revision to the cumulative impact discussion requirement (Section 15130) simply directs agencies to analyze GHG emissions in an EIR when a project's incremental contribution of emissions may be cumulatively considerable; however, it does not answer the question of when emissions are cumulatively considerable.

Section 15183.5 permits programmatic GHG analysis and later project-specific tiering, as well as the preparation of GHG Reduction Plans. Compliance with such plans can support a determination that a project's cumulative effect is not cumulatively considerable, according to Section 15183.5(b).

In addition, the 2010 CEQA amendments revised Appendix F of the CEQA Guidelines, which focuses on Energy Conservation. The sample environmental checklist in CEQA Guidelines Appendix G was amended to include GHG questions. The most recent sample environmental checklist in Appendix G was further amended in 2018 to include two energy questions.

CEQA emphasizes that the effects of GHG emissions are cumulative, and should be analyzed in the context of CEQA's requirements for cumulative impacts analysis (CEQA Guidelines § 15130(f)).

### *Center for Biological Diversity v. California Department of Fish and Wildlife (California Supreme Court GHG Ruling)*

In a November 30, 2015 ruling, the California Supreme Court in *Center for Biological Diversity (CBD) v. California Department of Fish and Wildlife* (CDFW) on the Newhall Ranch project concluded that whether the project was consistent with meeting Statewide emission reduction goals is a legally permissible criterion of significance, but the significance finding for the project was not supported by a reasoned explanation based on substantial evidence. The Court offered potential solutions on pages 25–27 of the ruling to address this issue summarized below:

Specifically, the Court advised that:

- **Substantiation of Project Reductions from BAU**. A lead agency may use a BAU comparison based on the Scoping Plan's methodology if it also substantiates the reduction a particular project must achieve to comply with statewide goals. The Court suggested a lead agency could examine the "data behind the Scoping Plan's business-as-usual model" to determine the necessary project-level reductions from new land use development at the proposed location (p. 25).
- **Compliance with Regulatory Programs or Performance Based Standards**. A lead agency "might assess consistency with A.B. 32's goal in whole or part by looking to compliance with regulatory programs designed to reduce greenhouse gas emissions from particular activities.

(See Final Statement of Reasons, supra, at p. 64 [greenhouse gas emissions 'may be best analyzed and mitigated at a programmatic level.'].)" To the extent a project's design features comply with or exceed the regulations outlined in the Scoping Plan and adopted by the Air Resources Board or other state agencies, a lead agency could appropriately rely on their use as showing compliance with 'performance based standards' adopted to fulfill 'a statewide . . . plan for the reduction or mitigation of greenhouse gas emissions' (CEQA Guidelines § 15064.4(a)(2), (b)(3); see also id., § 15064(h)(3) [determination that impact is not cumulatively considerable may rest on compliance with previously adopted plans or regulations, including 'plans or regulations for the reduction of greenhouse gas emissions']) (p. 26).

- **Compliance with GHG Reduction Plans or CAPs**. A lead agency may utilize "geographically specific GHG emission reduction plans" such as climate action plans or GHG emission reduction plans to provide a basis for the tiering or streamlining of project-level CEQA analysis (p. 26).
- **Compliance with Local Air District Thresholds**. A lead agency may rely on "existing numerical thresholds of significance for greenhouse gas emissions" adopted by, for example, local air districts (p. 27).

Therefore, consistent with 2019 CEQA Guidelines Appendix G, the three factors identified in CEQA Guidelines Section 15064.4 and the recently issued Newhall Ranch opinion, the GHG impacts would be considered significant if the project would:

- Conflict with a compliant GHG Reduction Plan if adopted by the lead agency;
- Exceed the applicable GHG Reduction Threshold; or
- Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emission of GHGs.

### *California SB 350: Clean Energy and Pollution Reduction Act*

In 2015, the State legislature approved and the Governor signed SB 350 which reaffirms California's commitment to reducing its GHG emissions and addressing climate change. Key provisions include an increase in the Renewables Portfolio Standard, higher energy efficiency requirements for buildings, initial strategies towards a regional electricity grid, and improved infrastructure for electric vehicle charging stations. Provisions for a 50 percent reduction in the use of petroleum Statewide were removed from the Bill due to opposition and concern that it would prevent the Bill's passage. Specifically, SB 350 requires the following to reduce Statewide GHG emissions:

- Increase the amount of electricity procured from renewable energy sources from 33 percent to 50 percent by 2030, with interim targets of 40 percent by 2024, and 25 percent by 2027.
- Double the energy efficiency in existing buildings by 2030. This target will be achieved through the California Public Utility Commission, the California Energy Commission, and local publicly owned utilities.

- Reorganize the Independent System Operator (ISO) to develop more regional electrify transmission markets and to improve accessibility in these markets, which will facilitate the growth of renewable energy markets in the western United States.[67]

### *California Executive Order B-30-15*

On April 29, 2015, an executive order was issued by the Governor to establish a California GHG emissions reduction target of 40 percent below 1990 levels by 2030. The Governor's executive order aligns California's GHG reduction targets with those of leading international governments ahead of the United Nations Climate Change Conference in Paris late 2015. The executive order sets a new interim statewide GHG emission reduction target to reduce GHG emissions to 40 percent below 1990 levels by 2030 in order to ensure California meets its target of reducing GHG emissions to 80 percent below 1990 levels by 2050, and directs the ARB to update the Climate Change Scoping Plan to express the 2030 target in terms of $MMCO_2e$. The executive order also requires the State's climate adaptation plan to be updated every three years and for the State to continue its climate change research program, among other provisions. As with Executive Order S-3-05, this executive order is not legally enforceable against local governments and the private sector. Legislation that would update AB 32 to make post 2020 targets and requirements a mandate is in process in the State Legislature.

### *California Senate Bill 32*

The Governor signed SB 32 in September of 2016, giving the ARB the statutory responsibility to include the 2030 target previously contained in Executive Order B-30-15 in the 2017 Scoping Plan Update. SB 32 states that "In adopting rules and regulations to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions reductions authorized by this division, the state [air resources] board shall ensure that statewide greenhouse gas emissions are reduced to at least 40 percent below the statewide greenhouse gas emissions limit no later than December 31, 2030." The 2017 Climate Change Scoping Plan Update addressing the SB 32 targets was adopted on December 14, 2017. The major elements of the framework proposed to achieve the 2030 target are as follows:

1. SB 350
   - Achieve 50 percent Renewables Portfolio Standard by 2030.
   - Doubling of energy efficiency savings by 2030.
2. Low Carbon Fuel Standard
   - Increased stringency (reducing carbon intensity 18 percent by 2030, up from 10 percent in 2020).
3. Mobile Source Strategy (Cleaner Technology and Fuels Scenario)
   - Maintaining existing GHG standards for light- and heavy-duty vehicles.
   - Put 4.2 million zero-emission vehicles (ZEVs) on the roads.
   - Increase ZEV buses, delivery and other trucks.

[67] California Legislative Information (California Leginfo). 2015. Senate Bill 350 Clean Energy and Pollution Reduction Act of 2015. Website: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350. Accessed September 28, 2017.

4. Sustainable Freight Action Plan
   - Improve freight system efficiency.
   - Maximize use of near-zero emission vehicles and equipment powered by renewable energy.
   - Deploy over 100,000 zero-emission trucks and equipment by 2030.
5. Short-Lived Climate Pollutant Reduction Strategy
   - Reduce emissions of methane and hydrofluorocarbons 40 percent below 2013 levels by 2030.
   - Reduce emissions of black carbon 50 percent below 2013 levels by 2030.
6. SB 375 Sustainable Communities Strategies
   - Increased stringency of 2035 targets.
7. Post-2020 Cap-and-Trade Program
   - Declining caps, continued linkage with Québec, and linkage to Ontario, Canada.
   - The ARB will look for opportunities to strengthen the program to support more air quality co-benefits, including specific program design elements. In Fall 2016, ARB staff described potential future amendments including reducing the offset usage limit, redesigning the allocation strategy to reduce free allocation to support increased technology and energy investment at covered entities and reducing allocation if the covered entity increases criteria or toxics emissions over some baseline.
8. 20 percent reduction in GHG emissions from the refinery sector.
9. By 2018, develop Integrated Natural and Working Lands Action Plan to secure California's land base as a net carbon sink.

### *California Code of Regulations Title 24*

*Part 6 (Energy Efficiency Standards for Residential and Nonresidential Buildings)*

California Code of Regulations Title 24 Part 6 (California's Energy Efficiency Standards for Residential and Nonresidential Buildings), was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods. Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases GHG emissions. The 2016 Building Energy Efficiency Standards went into effect on January 1, 2017.[68] The 2019 Building Energy Efficiency Standards are scheduled to go into effect on January 1, 2020.

*Part 11 (California Green Building Standards Code)*

California Code of Regulations Title 24, Part 11, is a comprehensive and uniform regulatory code for all residential, commercial, and school buildings that went in effect January 1, 2011. The code is updated on a regular basis, with the most recent update consisting of the 2016 California Green

[68] California Energy Commission (CEC). 2016. 2016 Building Energy Efficiency Standards Frequently Asked Questions. Website: http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf. Accessed December 1, 2016.

Building Code Standards that became effective January 1, 2017.[69] Local jurisdictions are permitted to adopt more stringent requirements, as state law provides methods for local enhancements. The Code recognizes that many jurisdictions have developed existing construction and demolition ordinances, and defers to them as the ruling guidance provided they provide a minimum 50-percent diversion requirement. The code also provides exemptions for areas not served by construction and demolition recycling infrastructure. State building code provides the minimum standard that buildings need to meet in order to be certified for occupancy, which is generally enforced by the local building official.

### *California Model Water Efficient Landscape Ordinance*

The Model Water Efficient Landscape Ordinance (Ordinance) was required by AB 1881 Water Conservation Act. The bill required local agencies to adopt a local landscape ordinance at least as effective in conserving water as the Model Ordinance by January 1, 2010. Reductions in water use of 20 percent consistent with (SBX-7-7) 2020 mandate are expected for Ordinance. Governor Brown's Drought Executive Order of April 1, 2015 (EO B-29-15) directed the Department of Water Resources (DWR) to update the Ordinance through expedited regulation. The California Water Commission approved the revised Ordinance on July 15, 2015, which became effective on December 15, 2015. New development projects that include landscaped areas of 500 square feet or more are subject to the Ordinance. The update requires:

- More efficient irrigation systems
- Incentives for graywater usage
- Improvements in on-site stormwater capture
- Limiting the portion of landscapes that can be planted with high water use plants
- Reporting requirements for local agencies.

### *California Green Building Code*

The Building Energy Efficiency Standards for Residential and Nonresidential Buildings (California Code of Regulations Title 24, Part 6) were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technology and methods. The most recent update of standards became effective in January 1, 2017. California's building efficiency standards (including standards for energy-efficient appliances). The Energy Commission staff has estimated that the implementation of the 2016 Building Energy Efficiency Standards may reduce Statewide annual electricity consumption by approximately 281 gigawatt-hours per year and reduce GHG emissions by 160 thousand metric tons $CO_2e$ per year.[70]

[69] California Building Standards Commission (CBSC). 2016. Green Building Standards. Website: https://www.ladbs.org/docs/default-source/publications/code-amendments/2016-calgreen_complete.pdf?sfvrsn=6. Accessed June 27, 2017.

[70] California Energy Commission (CEC). 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. Website: https://www.energy.ca.gov/2015publications/CEC-400-2015-037/CEC-400-2015-037-CMF.pdf.

## Regional

### *Bay Area 2017 Clean Air Plan*

BAAQMD is responsible for attaining and maintaining federal and state air quality standards in the San Francisco Bay Area Air Basin, as established by the federal CAA and the California Clean Air Act (CCAA), respectively. The CAA and CCAA require that plans be developed for areas that do not meet air quality standards. BAAQMD adopted the Bay Area Clean Air Plan: Spare the Air, Cool the Climate (Bay Area Clean Air Plan) on April 19, 2017, to provide a regional strategy to improve Bay Area air quality and meet public health goals.[71] The control strategy described in the Bay Area Clean Air Plan includes a wide range of control measures designed to reduce emissions and lower ambient concentrations of harmful pollutants, safeguard public health by reducing exposure to air pollutants that pose the greatest health risk, and reduce GHG emissions to protect the climate.

In addition, BAAQMD established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the San Francisco Bay Area Air Basin. The program includes GHG-reduction measures that promote energy efficiency, reduce vehicle miles traveled, and develop alternative energy sources.[72]

The BAAQMD CEQA Air Quality Guidelines also assist lead agencies in complying with CEQA requirements regarding potentially adverse impacts on air quality. BAAQMD advises lead agencies to consider adopting a GHG reduction strategy capable of meeting AB 32 goals. This is consistent with the approach to analyzing GHG emissions described in State CEQA Guidelines Section 15183.5.

## Local

### *Contra Costa County General Plan*

The Contra Costa County General Plan establishes goals, objectives, and policies associated with GHG emissions.[73] Those goals and policies that are relevant to this analysis are listed below.

*Conservation Element*

- **Goal 8-C**: To achieve a balance of uses of the County's natural and developed resources to meet the social and economic needs of the County's residents.
- **Goal 8-K:** To encourage the use of renewable resources where they are compatible with the maintenance of environmental quality.
- **Goal 8-L:** To reduce energy use in the County to avoid risks of air pollution and energy shortages which could prevent orderly development.
- **Goal 8-AD**: To reduce the percentage of Average Daily Traffic (ADT) trips occurring at peak hours.
- **Policy 8-101**: A safe, convenient and effective bicycle and trail system shall be created and maintained to encourage increased bicycle use and walking as alternatives to driving.

[71] Bay Area Air Quality Management District (BAAQMD). 2017. Final 2017 Clean Air Plan. Website: http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en. Accessed April 24, 2018.

[72] Bay Area Air Quality Management District (BAAQMD). 2010. Climate Protection Planning Program. Website: http://www.baaqmd.gov/plans-and-climate/climate-protection/climate-protection-program. Accessed June 5, 2018.

[73] Contra Costa County. 2005 (includes 2010 reprint revisions). Contra Costa County General Plan. Website: http://www.co.contra-costa.ca.us/4732/General-Plan. Accessed February 26, 2019.

- **Policy 8-102**: A safe and convenient pedestrian system shall be created and maintained in order to encourage walking as an alternative to driving.
- **Policy 8-107**: New housing in infill and peripheral areas which are adjacent to existing residential development shall be encouraged.

*Transportation and Circulation Element*

- **Goal 5-C**: To balance transportation and circulation needs with the desired character of the community.
- **Goal 5-I**: To encourage use of transit.
- **Goal 5-J**: To reduce single-occupant auto commuting and encourage walking and bicycling.
- **Goal 5-L**: To reduce GHG emissions from transportation sources through provision of transit, bicycle, and pedestrian facilities.
- **Policy 5-3**: Transportation facilities serving new urban development shall be linked to and compatible with existing and planned roads, bicycle facilities, pedestrian facilities and pathways of adjoining areas, and such facilities shall use presently available public and semi-public rights of way where feasible.
- **Policy 5-23**: All efforts to develop alternative transportation systems to reduce peak period traffic congestion shall be encouraged.
- **Policy 5-24**: Use of alternative forms of transportation, such as transit, bike and pedestrian modes, shall be encouraged in order to provide basic accessibility to those without access to a personal automobile and to help minimize automobile congestion and air pollution.
- **Policy 5-25**: Improvement of public transit shall be encouraged to provide for increased use of local, commuter and intercity public transportation.

### *Contra Costa County CAP*

On December 15, 2015, the Contra Costa County CAP was approved by the Board of Supervisors.[74] The CAP identifies specific measures on how the County can achieve a GHG reduction target of 15 percent below baseline levels by the year 2020. In addition to reducing GHG emissions, the CAP includes proposed policies and actions to improve public health and provide additional community benefits, and it lays the groundwork for achieving long-term GHG reduction goals for 2020 and 2035.

## 3.7.4 - Impacts and Mitigation Measures

According 2019 CEQA Guidelines Appendix G, to determine whether impacts related to GHG emissions are significant environmental effects, the following questions are analyzed and evaluated. Would the project:

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

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

[74] Contra Costa County. 2015. Contra Costa County CAP. Website: http://www.co.contra-costa.ca.us/4554/Climate-Action-Plan. Accessed February 26, 2019.

## Approach to Analysis

### *GHG Emissions Generation Calculation Methodology*

The California Emissions Estimator Model (CalEEMod) version 2016.3.2 was used to estimate the project's construction and operation-related GHG emissions. CalEEMod was developed in cooperation with air districts throughout the State and is designed as a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential GHG emissions associated with construction and operation from a variety of land uses.

*Construction*

Construction emissions can vary substantially from day to day, depending on the level of activity, the specific type of operation, and prevailing weather conditions. Construction emissions result from on-site and off-site activities. On-site GHG emissions principally consist of exhaust emissions from heavy-duty construction equipment. Off-site GHG emissions would occur from motor vehicle exhaust from material delivery vehicles and construction worker traffic.

Construction activities would consist of demolition, mass grading, building construction, asphalt paving of roadways, and architectural coating of the inside and outside of the buildings. For each construction activity, the construction equipment operating hours and numbers represent the average equipment activity over the duration of the activity. The project is anticipated to begin in July 2020 and last approximately two years. The construction schedule used in the analysis represents a "worst-case" analysis scenario since emission factors for construction equipment decrease as the analysis year increases, due to improvements in technology and compliance with more stringent regulatory requirements. Therefore, construction emissions would decrease if the construction schedule moves to later years.

The duration of construction activity and associated equipment represent a reasonable approximation of the expected construction fleet as required by the CEQA Guidelines. Full construction emissions modeling parameters and assumptions are provided in Appendix B.

*Operation*

Operational GHG emissions are those GHG emissions that would occur during long-term operation of the project. Project operations were modeled for the year 2022 and the year 2030. The major sources for operational GHG emissions are summarized below.

**Motor Vehicles**

These emissions refer to GHG emissions contained in the exhaust from the cars and trucks that would travel to and from the project site. Trip generation rates used in estimating mobile-source emissions were consistent with those presented in the Del Hombre Apartments Transportation Impact Assessment (TIA) prepared by Fehr and Peers. As detailed in the TIA, the project is expected to generate approximately 1,800 net daily vehicle trips. The vehicle trips estimated by for the project includes a 20-percent reduction based on the project's proximity to existing transit and pedestrian pathways and five-percent increase to account for Transportation Company use.

**Natural Gas**

These emissions refer to the GHG emissions that occur when natural gas is burned on the project site. Natural gas uses could include heating water, space heating, dryers, stoves, or other uses.

**Indirect GHG Emissions**

For GHG emissions, CalEEMod contains calculations to estimate indirect GHG emissions. Indirect emissions are emissions where the location of consumption or activity is different from where the actual emissions are generated. For example, electricity would be consumed at the proposed apartment building; however, the emissions associated with producing that electricity are generated off-site at a power plant.

CalEEMod includes calculations for indirect GHG emissions for electricity consumption, water consumption, and solid waste disposal. For water consumption, CalEEMod calculates the embedded energy (e.g., treatment, conveyance, and distribution) associated with providing each gallon of potable water to the project. For solid waste disposal, CalEEMod calculates the GHG emissions generated as solid waste generated by the project decomposes in a landfill.

For electricity-related emissions, CalEEMod contains default electricity intensity factors for various utilities throughout California. For the purposes of the project, emission factors for PG&E were selected to quantify electricity emissions. The project is proposed to be operational in the year 2022. As such, the $CO_2$ emission factor was adjusted consistent to the SB-1078 RPS goal of achieving utility providers achieving 33 percent mix of renewable energy in their retail sales. The adjusted PG&E CalEEMod emission factors are shown below for the year 2022.

- **Carbon dioxide:** 491.65 pound per megawatt hour (lb/MWh)
- **Methane:** 0.029 lb/MWh
- **Nitrous oxide:** 0.006 lb/MWh

SB 350 requires an increase in the amount of electricity procured from renewable energy sources from 33 percent to 50 percent by 2030. Therefore, the adjusted PG&E CalEEMod emission factors are shown below for the year 2030.

- **Carbon dioxide:** 366.91 pound per megawatt hour (lb/MWh)
- **Methane:** 0.029 lb/MWh
- **Nitrous oxide:** 0.006 lb/MWh

**Refrigerants**

During operation, there may be leakage of refrigerants from air conditioners and the refrigeration system. HFCs are typically used for refrigerants, which are long-lived GHGs. Residential uses of refrigerants are minor; therefore, they were not estimated.

**Life Cycle Emissions**

An upstream GHG emissions source (also known as life cycle emissions) refers to emissions that are generated during the manufacturing and transportation of products that would be utilized for project construction. Upstream emission sources for construction of the project include but are not limited to GHG emissions from the manufacturing of cement and steel as well as from the transportation of

building materials to the seller of such products. The upstream emissions associated with construction of the project has not been estimated as part of this impact analysis, because such upstream emissions are not within the control of the project, the information is not readily available, and to characterize these emissions would be speculative. Additionally, the California Air Pollution Control Officers Association (CAPCOA) White Paper on CEQA and Climate Change supports this approach by stating, "The full life-cycle of GHG emissions from construction activities is not accounted for . . . and the information needed to characterize [life-cycle emissions] would be speculative at the CEQA analysis level."[75] Therefore, pursuant to CEQA Guidelines Sections 15144 and 15145, upstream/life cycle emissions are speculative, and is not further discussed as part of this impact analysis.

**Vegetation**

There is currently carbon sequestration occurring on-site from existing vegetation. Specifically, the project site contains non-native grassland and approximately 189 trees. As stated in Section 3.3, Biological Resources, foliage present on the project site can be characterized as a mixed oak woodland, dominated by valley oak (*Quercus lobata*) and coast live oak (*Quercus agrifolia*), in conjunction with a variety of other mature, adult tree species.[76] To facilitate the development of the proposed apartment building, the project includes the removal of approximately 161 trees (approximately 145 code-protected trees and approximately 16 not code-protected). The project would plant trees and integrate landscaping into the project design, which would provide carbon sequestration. However, data are insufficient to accurately determine the impact that existing plants have on carbon sequestration. For this analysis, it was assumed that the loss and addition of carbon sequestration that are due to the project would be balanced; therefore, emissions due to carbon sequestration were not included.

### *GHG Emissions Reduction Plan Consistency Determination Methodology*

In determining whether a project or plan conflicts with any applicable plan, policy, or regulation, the California Natural Resources Agency has stated that in order to be used for the purpose of determining significance, an applicable plan, policy, or regulation must contain specific requirements that result in reductions of GHG emissions to a less than significant level. The project is assessed for its consistency with the Contra Costa County CAP. This would be achieved with an assessment of the project's compliance with applicable measures contained in the CAP.

## Specific Thresholds of Significance

### *GHG Emissions Generation*

Contra Costa County utilizes BAAQMD quantitative thresholds for evaluation of GHG emissions. BAAQMD provides multiple options in its 2017 BAAQMD CEQA Guidelines for operational GHG emissions generation significance thresholds. However, at the time of this analysis, BAAQMD has not yet provided a construction-related GHG emissions generation significance threshold, but it does recommend that construction-generated GHGs be quantified and disclosed.

[75] California Air Pollution Control Officers Association (CAPCOA). 2008. CEQA & Climate Change, Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to California Environmental Quality Act (CEQA). Available: http://www.capcoa.org/wp-content/uploads/2012/03/CAPCOA-White- Paper.pdf. Accessed: December 18, 2011.

[76] Hort Science. 2019. Tree Inventory Report, Del Hombre Lane Contra Costa County, CA. May.

BAAQMD's project-level significance threshold for operational GHG generation was deemed appropriate to use when determining the project's potential GHG impacts. The thresholds suggested by BAAQMD are as follows:

- Compliance with a qualified GHG Reduction Strategy, or
- 1,100 MT $CO_2e$ per year, or
- 4.6 MT $CO_2e$ per service population (employees plus residents) per year.

It should be noted that the BAAQMD's thresholds of significance was established based on meeting the 2020 GHG targets set forth in the AB 32 Scoping Plan. For developments that would occur beyond 2020, the service population threshold of significance was adjusted to a "substantial progress" threshold that was calculated based on the SB 32 target of 40 percent below 1990 levels and the forecasted 2030 service population.

### *GHG Emissions Reduction Plan Consistency*

The project would be determined to conflict with an applicable GHG emissions reduction plan if it would not adhere to applicable GHG reduction measures included in the Contra Costa County CAP.

## Impact Evaluation

### *GHG Emissions Generation*

| | |
|---|---|
| **Impact GHG-1:** | **Implementation of the project would generate direct and indirect greenhouse gas emissions; however, these emissions would not result in a significant impact on the environment.** |

This GHG emissions generation analysis is restricted to emissions of the GHGs identified as those of California concern by AB 32, which include $CO_2$, $CH_4$, $N_2O$, HFC, PFC, and $SF_6$. As such, project-related $CO_2e$ emissions discussed below are limited to a combination of emissions of $CO_2$, $CH_4$, $N_2O$, HFC, PFC, and $SF_6$. The project would generate a variety of GHG emissions during construction and operation, including several defined by AB 32 such as $CO_2$, methane, and nitrous oxide.

Certain GHGs defined by AB 32 would not be generated by the project, such as PFCs and $SF_6$. PFC and $SF_6$ are typically used in industrial applications, none of which would be used during construction or operation of the project; therefore, it is not anticipated that the project would emit PFC or $SF_6$. As discussed in Approach to Analysis, it is not anticipated the project would emit substantial quantities of HFC.

### *Construction and Operation*

This impact discussion combines amortized construction GHG emissions and operational GHG emissions to determine total project GHG emissions.

The project would emit GHG emissions during construction from the off-road construction equipment, worker vehicles, and any hauling that may occur. Total GHG emissions generated during all construction activities were quantified and combined and are presented in Table 3.7-4. In order to assess the construction emissions, the total emissions generated during construction were amortized based on the life of the development (30 years) and added to the operational emissions.

Construction of the project is estimated to generate approximately 875 MT $CO_2e$. The amortized emissions from construction were added to the operational emissions to determine the total emissions of the project. These total project emissions were analyzed against the 2020 BAAQMD efficiency threshold of 4.6 MT $CO_2e$/service population/year and the projected 2030 efficiency threshold of 2.6 MT $CO_2e$/service population/year.

**Table 3.7-4: Unmitigated Project Construction GHG Emissions**

| Construction Activity | Total Emissions (MT $CO_2e$/year) |
|---|---|
| **2020** | |
| Demolition | 7 |
| Site Preparation | 4 |
| Grading—2020 | 176 |
| **2021** | |
| Grading—2021 | 14 |
| Building Construction—2021 | 455 |
| **2022** | |
| Building Construction—2022 | 157 |
| Architectural Coating | 53 |
| Paving | 5 |
| Off-site Road Improvements | 4 |
| **2020–2022** | |
| **Total Construction Emissions** | **875** |
| **Construction Emissions Amortized Over the Life of the Project (30 years)** | **29** |
| Note:<br>As noted in Appendix B and discussed in Section 3.2, Air Quality, all construction equipment other than cranes and forklifts were assumed to be diesel-powered. Consistent with applicant-provided information, it was assumed that cranes would be powered by electricity, and forklifts would be powered by liquid propane or compressed natural gas.<br>Source: CalEEMod Output (see Appendix B). | |

As shown in Table 3.7-4, during construction the project would generate approximately 875 MT $CO_2e$, which is approximately 29 MT $CO_2e$ pre year when amortized over 30 years.

Operational or long-term emissions occur over the life of a project. The operational GHG emissions from the project are combined with the amortized construction emissions and compared with the BAAQMD's per-service-population threshold to make a significance determination. Sources for operational emissions include:

- **Motor Vehicles:** These emissions refer to GHG emissions contained in the exhaust from the cars and trucks that would travel to and from the project site.

- **Natural Gas:** These emissions refer to the GHG emissions that occur when natural gas is burned on the project site. Natural gas uses could include heating water, space heating, dryers, stoves, or other uses.
- **Indirect Electricity:** These emissions refer to those generated by off-site power plants to supply electricity required for the project.
- **Water Transport:** These emissions refer to those generated by the electricity required to transport and treat the water to be used on the project site.
- **Waste:** These emissions refer to the GHG emissions produced by decomposing waste generated by the project.

Operational GHG emissions by source are shown in Table 3.7-5. As previously indicated, the analysis includes construction emissions amortized over the project's life. The project would generate approximately 2,346 MT $CO_2e$ per year with the addition of amortized construction emissions. The project is expected to accommodate 818 residents and five employees, resulting in a service population of 823. The estimated total annual project-generation emissions, including operational emissions and amortized construction emissions, were compared with the efficiency threshold of 4.6 MT $CO_2e$/service population/year to determine significance at project buildout in the year 2022. The estimated total annual GHG emissions generated by the project in the year 2030 were compared with the applicable threshold of 2.6 MT $CO_2e$/service population/year.

**Table 3.7-5: Project Operational GHG Emissions (Unmitigated)**

| Emission Source | Year 2022 Total Emissions (MT $CO_2e$ per year) | Year 2030 Total Emissions (MT $CO_2e$ per year) |
|---|---|---|
| Area | 9 | 9 |
| Energy | 615 | 493 |
| Mobile | 1,599 | 1,269 |
| Waste | 49 | 49 |
| Water | 45 | 39 |
| Amortized Construction Emissions | 29 | 29 |
| *Total Project Emissions* | *2,346* | *1,888* |
| Service Population (Employees + Residents) | **823** | **823** |
| **Project Emission Generation (MT $CO_2e$/service population/year)** | **2.9** | **2.3*** |
| **BAAQMD 2017 Threshold (MT $CO_2e$/service population/year)** | **4.6** | **2.6** |
| **Does Project exceed threshold?** | **No** | **No** |

Notes:
MT $CO_2e$ = metric tons of carbon dioxide equivalent.
* Adjusted threshold to account for 2017 Scoping Plan Update 40% Reduction Goal by 2030
Source of Emissions: CalEEMod Output (Appendix B)

As shown in Table 3.7-5, the project would generate approximately 2.9 MT $CO_2e$ per service person per year in the year 2022 and 2.3 MT $CO_2e$ per service person per year in the year 2030 in terms of total (amortized construction plus operational) project GHG emissions. Therefore, the project would not exceed the BAAQMD's threshold of 4.6 MT $CO_2e$/service population/year or the projected 2.6 MT $CO_2e$/service population/year for the 2030 GHG emissions. Therefore, the impact related to construction and operational GHG emissions would be less than significant.

### *Level of Significance*

Less Than Significant

### *GHG Emissions Reduction Plan Consistency*

**Impact GHG-2: Implementation of the project would not conflict with any applicable plan, policy, or regulation of an agency adopted to reduce the emissions of greenhouse gases.**

Significance for this impact is determined by project compliance with the Contra Costa County CAP.

### *Construction*

Impacts related to a project's consistency with a GHG emissions reduction plan are primarily related to long-term operational activities. However, short-term construction activities would comply with and use equipment and fuel consistent with Statewide requirements. Because construction of the project would not conflict with the Contra Costa County CAP, the construction impact related to consistency with an applicable GHG emissions reduction plan would be less than significant.

### *Operation*

*Contra Costa County CAP Consistency*

As discussed in Section 3.7.3, Regulatory Framework, the Board of Supervisors approved the Contra Costa County CAP in December of 2015. The CAP identifies specific measures on how the County can achieve a GHG reduction target of 15 percent below baseline levels by the year 2020. In addition to reducing GHGs, the CAP includes policies and actions to improve public health and provide additional community benefits, and it lays the groundwork for achieving long-term greenhouse reduction goals for 2020 and 2035 a qualified GHG Reduction Strategy. The CAP contains an analysis demonstrating that it meets the BAAQMD's minimum standards for a qualified GHG reduction strategy. The CAP includes a project consistency checklist that was created to help both project applicants and County staff determine where a proposed new development project is consistent with the CAP. The checklist is to be filled out for each new project subject to discretionary review. As stated in the CAP, the County would work with applicants on a project-by-project basis to identify appropriate measures to integrate with the project through conditions of approval or project design, or other techniques as applicable. This approach allows the County to ensure that new projects are consistent with and do not compromise the County's ability to attain the GHG reduction targets outlined in this CAP. To assist with implementation, the checklist provides descriptions and performance criteria that explain how individual projects can comply with requirements. The individual project criterion clarifies implementation of the CAP, providing additional information that is consistent with the assumptions identified in Appendix D of the CAP.

The CAP checklist measures applicable residential development and the project's consistency with these measures are described below.

> **EE 1 and EE 6.** New residential development will install high-efficiency appliances and insulation to prepare for the statewide transition to zero net energy.

The project would install new high efficiency appliances meeting Title 20 appliance efficiency standards. Insulation and other building envelope related energy efficiency requirements would be required to meet the applicable Title 24 Energy Efficiency Standards in effect at the time building permits are received. The current version of Title 24 is the 2016 Title 24 update that went into effect January 1, 2017. The 2019 Title 24 energy standards will go into effect January 1, 2020 and are estimated to be 5 percent more stringent compared to the 2016 Title 24 energy standards.

> **RE 1.** New residential and nonresidential development will meet the standards to be solar ready as defined by the California Building Standards Code.

The project would comply with the California Building Codes Standards requiring proposed apartment building to be solar ready.

> **LUT 2.** New single-family houses and multi-family units with private attached garages or carports will provide prewiring for EV charging stations inside the garage or carport.

The proposed building would be required to provide wiring that would allow installation of EV charging equipment in any private garages or carports.

> **LUT 4.** New residential and nonresidential development will be located within one half-mile of a BART or Amtrak station, or within one quarter-mile of bus station.

As described in Chapter 2, Project Description, the project is located approximately 0.12 mile from the nearest bus stop and 0.12 mile from the nearest Bay Area Rapid Transit (BART) Station.

Based on the project's compliance with the CAP checklist measures described above, the project would be consistent with the measures in the CAP. However, the CAP requires completion of a Development Checklist to ensure that new projects are consistent with and do not compromise Contra Costa County's ability to attain the GHG reduction targets outlined in the CAP. Since the project description currently does not include completion of the Development Checklist, implementation of the project could conflict with the CAP. To ensure compliance and consistency with the CAP, Mitigation Measure (MM) GHG-2 requires that the project applicant submit a completed development checklist prior to the issuance of building permits. Thus, with implementation of MM GHG-2, the project would not conflict with any applicable plan, policy or regulation of an agency adopted to reduce the emissions of GHGs. Therefore, the GHG emissions reduction plan consistency impact would be less than significant with mitigation.

### *Level of Significance Before Mitigation*

Potentially Significant

### *Mitigation Measures*

**MM GHG-2 Prepare Climate Action Plan (CAP) Development Checklist**

Prior to issuance of building permits, the applicant shall prepare and submit a CAP Development Checklist completed for the project to the County of Contra Costa that demonstrates to the County's satisfaction that project would be constructed and operated to be consistent with measures required in the CAP Development Checklist.

### *Level of Significance After Mitigation*

Less Than Significant with Mitigation

## 3.7.5 - Cumulative Impacts

GHG emissions and global climate change inherently represent cumulative impacts. GHG emissions cumulatively contribute to the significant adverse environmental impacts of global climate change. No single project could generate enough GHG emissions to noticeably change the global average temperature; instead, the GHG emissions from past, present, and future projects and activities have contributed to and would contribute to global climate change and its associated environmental impacts.

According to the BAAQMD, project GHG emissions are inherently cumulative and do not require the estimation of cumulative projects in the region of the project. CAPs and the BAAQMD thresholds are based on the State goals. Thus, the determination of GHG cumulative impacts is based on the State target established by AB 32 to reduce GHG emissions to 1990 levels by 2020. In order to ensure that this goal would be achieved, Air Districts and Lead Agencies developed GHG thresholds to ensure compliance with the State target. As stated in Appendix D of the 2017 BAAQMD CEQA Guidelines, projects with GHG emissions in conformance with these thresholds, therefore, would not be considered significant for purposes of CEQA. In addition, although the emissions from such cumulative projects would add an incremental amount to the overall GHG emissions that cause global climate change impacts, emissions from projects consistent with these thresholds would not be a "cumulatively considerable" contribution under CEQA. Such projects would not be "cumulatively considerable," because they would be helping to solve the cumulative problem as a part of the AB 32 process. As such, there would be a less than significant impact related to GHG emissions generation.

### Level of Cumulative Significance

Less Than Significant

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