D. GLOBAL CLIMATE CHANGE

This chapter presents general background information on global climate change, meteorology, the regulatory framework for global climate change, and provides data on the existing global climate setting and greenhouse gas (GHG) emissions in the vicinity of the City of Larkspur and the SMART Station Area Plan (Plan) area.

1. Setting

The following section provides background information on GHG emissions and global climate change.

a. Greenhouse Gases. Global climate change is the observed increase in the average temperature of the Earth's atmosphere and oceans in recent decades. Global surface temperatures have risen by 1.1 ± 0.4° Fahrenheit (°F) over the last 100 years (1906 to 2005). The rate of warming over the last 50 years is almost double that over the last 100 years.[1] The prevailing scientific opinion on climate change is that most of the warming observed over the last 50 years is attributable to human activities. The increased amounts of carbon dioxide (CO_2) and other GHGs are the primary causes of the human-induced component of warming. GHGs are released by the burning of fossil fuels, land clearing, agriculture, and other activities, and lead to an increase in the greenhouse effect.[2]

GHGs are present in the atmosphere naturally, are released by natural sources, or are formed from secondary reactions taking place in the atmosphere. The gases that are widely seen as the principal contributors to human-induced global climate change are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur Hexafluoride (SF_6)

Over the last 200 years, humans have caused substantial quantities of GHGs to be released into the atmosphere. These extra emissions are increasing GHG concentrations in the atmosphere, and enhancing the natural greenhouse effect, which is believed to be causing global warming. While manmade GHGs include naturally-occurring GHGs such as CO_2, methane, and N_2O, some gases, like HFCs, PFCs, and SF_6 are completely new to the atmosphere.

[1] 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 IPCC.

[2] The temperature on Earth is regulated by a system commonly known as the "greenhouse effect." Just as the glass in a greenhouse lets heat from sunlight in and reduces the heat escaping, GHGs like carbon dioxide, methane, and nitrous oxide in the atmosphere keep the Earth at a relatively even temperature. Without the greenhouse effect, the Earth would be a frozen globe; thus, although an excess of GHG results in global warming, the naturally occurring greenhouse effect is necessary to keep our planet at a comfortable temperature.

Certain gases, such as water vapor, are short-lived in the atmosphere. Others remain in the atmosphere for significant periods of time, contributing to climate change in the long term. Water vapor is excluded from the list of GHGs above because it is short-lived in the atmosphere and its atmospheric concentrations are largely determined by natural processes, such as oceanic evaporation.

Gases vary considerably in terms of Global Warming Potential (GWP), which is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to another gas. The global warming potential is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and length of time that the gas remains in the atmosphere ("atmospheric lifetime"). The GWP of each gas is measured relative to carbon dioxide, the most abundant GHG; the definition of GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to the ratio of heat trapped by one unit mass of CO_2 over a specified time period. Greenhouse gas emissions are typically measured in terms of pounds or tons of "CO_2 equivalents" (CO_2e). Table IV. D-1 shows the GWPs for each type of GHG. For example, sulfur hexafluoride is 22,800 times more potent at contributing to global warming than carbon dioxide.

The following discussion summarizes the characteristics of the six GHGs.

Table IV.D-1: Global Warming Potential of Greenhouse Gases

Gas	Atmospheric Lifetime (Years)	Global Warming Potential (100-year Time Horizon)
Carbon Dioxide	50-200	1
Methane	12	25
Nitrous Oxide	114	298
HFC-23	270	14,800
HFC-134a	14	1,430
HFC-152a	1.4	124
PFC: Tetrafluoromethane (CF_4)	50,000	7,390
PFC: Hexafluoromethane (C_2F_6)	10,000	12,200
Sulfur Hexafluoride (SF_6)	3,200	22,800

Source: IPCC, 2007. *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

(1) Carbon Dioxide (CO_2). In the atmosphere, carbon generally exists in its oxidized form, as CO_2. Natural sources of CO_2 include the respiration (breathing) of humans, animals and plants, volcanic outgassing, decomposition of organic matter and evaporation from the oceans. Human caused sources of CO_2 include the combustion of fossil fuels and wood, waste incineration, mineral production, and deforestation. Natural sources release approximately 150 billion tons of CO_2 each year, far outweighing the 7 billion tons of man-made emissions of CO_2 each year. Nevertheless, natural removal processes, such as photosynthesis by land- and ocean-dwelling plant species, cannot keep pace with this extra input of man-made CO_2, and consequently, the gas is building up in the atmosphere.

In 2002, CO_2 emissions from fossil fuel combustion accounted for approximately 98 percent of man-made CO_2 emissions and approximately 84 percent of California's overall GHG emissions (CO_2e). The transportation sector accounted for California's largest portion of CO_2 emissions, with gasoline consumption making up the greatest portion of these emissions. Electricity generation was California's second largest category of GHG emissions.

(2) Methane (CH_4). Methane is produced when organic matter decomposes in environments lacking sufficient oxygen. Natural sources include wetlands, termites, and oceans. Decomposition occurring in landfills accounts for the majority of human-generated CH_4 emissions in California and in the United States as a whole. Agricultural processes such as intestinal fermentation, manure management, and rice cultivation are also significant sources of CH_4 in California. Methane accounted for approximately 6 percent of gross climate change emissions (CO_2e) in California in 2002.

Total annual emissions of methane are approximately 500 million tons, with manmade emissions accounting for the majority. As with CO_2, the major removal process of atmospheric methane – a chemical breakdown in the atmosphere – cannot keep pace with source emissions, and methane concentrations in the atmosphere are increasing.

(3) Nitrous Oxide (N_2O). Nitrous oxide is produced naturally by a wide variety of biological sources, particularly microbial action in soils and water. Tropical soils and oceans account for the majority of natural source emissions. Nitrous oxide is a product of the reaction that occurs between nitrogen and oxygen during fuel combustion. Both mobile and stationary combustion emit N_2O, and the quantity emitted varies according to the type of fuel, technology, and pollution control device used, as well as maintenance and operating practices. Agricultural soil management and fossil fuel combustion are the primary sources of human-generated N_2O emissions in California. Nitrous oxide emissions accounted for nearly 7 percent of man-made GHG emissions (CO_2e) in California in 2002.

(4) Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF_6). HFCs are primarily used as substitutes for ozone-depleting substances regulated under the Montreal Protocol.[3] PFCs and SF_6 are emitted from various industrial processes, including aluminum smelting, semiconductor manufacturing, electric power transmission and distribution, and magnesium casting. There is no aluminum or magnesium production in California; however, the rapid growth in the semiconductor industry leads to greater use of PFCs. HFCs, PFCs, and SF_6 accounted for about 3.5 percent of man-made GHG emissions (CO_2e) in California in 2002.

b. Impacts of Climate Change. The potential impacts of global climate change are described in the following section.

(1) Temperature Increase. The latest projections, based on state-of-the art climate models, indicate that temperatures in California are expected to rise 3 to 10.5°F by the end of the century.[4] Because GHGs persist for a long time in the atmosphere, accumulate over time, and are generally well-mixed, their impact on the atmosphere cannot be tied to a specific point of emission.

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from:

[3] The Montreal Protocol is an international treaty that was approved on January 1, 1989, and was designated to protect the ozone layer by phasing out the production of several groups of halogenated hydrocarbons believed to be responsible for ozone depletion.

[4] California Climate Change Center, 2006. *Our Changing Climate. Assessing the Risks to California.* July.

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (e.g., changes in ocean circulation and reduction in sunlight from the addition of GHGs and other gases to the atmosphere from volcanic eruptions); or
- Human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., from deforestation, reforestation, urbanization, and desertification).

The primary effect of global climate change has been a rise in the average global temperature. The impact of human activities on global climate change is readily apparent in the observational record. For example, surface temperature data show that 11 of the 12 years from 1995 to 2006 rank among the 12 warmest since 1850, the beginning of the instrumental record for global surface temperature.[5] Climate change modeling shows that further warming could occur, which would induce additional changes in the global climate system during the current century. Changes to the global climate system, ecosystems, and the environment of California could include, but are not limited to:

- The loss of sea ice and mountain snow pack, resulting in higher sea levels and higher sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures;
- Rise in global average sea level primarily due to thermal expansion and melting of glaciers and ice caps in the Greenland and Antarctic ice sheets;
- Changes in weather that include widespread changes in precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather, including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones;
- Decline of the Sierra snowpack, which accounts for a significant amount of the surface water storage in California, by 70 percent to as much as 90 percent over the next 100 years;
- Increase in the number of days conducive to ozone formation by 25 to 85 percent (depending on the future temperature scenario) in high ozone areas of Los Angeles and the San Joaquin Valley by the end of the 21st century; and
- High potential for erosion of California's coastlines and seawater intrusion into the Delta and levee systems due to the rise in sea level.

(2) Precipitation and Water Supply. Global average precipitation is expected to increase overall during the 21st century as the result of climate change, but will vary in different parts of the world. However, global climate models are generally not well suited for predicting regional changes in precipitation because of the scale of regionally important factors, such as the proximity of mountain ranges that affect precipitation.[6]

[5] California, State of, 2008. California Energy Commission's Public Interest Energy Research Program. *The Future is Now: An Update on Climate Change Science, Impacts, and Response Options for California*. September.

[6] Intergovernmental Panel on Climate Change, 2007. *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the IPCC.

Most of California's precipitation falls in the northern part of the State during the winter. A vast network of man-made reservoirs and aqueducts capture and transport water throughout the State from northern California rivers, as the greatest demand for water comes from users in the southern part of the State during the spring and summer.[7] The current distribution system relies on Sierra Nevada mountain snowpack to supply water during the dry spring and summer months. Rising temperatures, potentially compounded by decreases in precipitation, could severely reduce spring snowpack, increasing the risk of summer water shortages.

Some models predict drier conditions and decreased water flows, while others predict wetter conditions in various parts of the world. 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 over the next 100 years.

The extent to which various meteorological conditions will impact groundwater supply is unknown. Warmer temperatures could increase the period when water is on the ground by reducing soil freeze. However, warmer temperatures could also lead to higher evaporation or shorter rainfall seasons, shortening the recharge season. Warmer winters could increase the amount of runoff available for groundwater recharge. However, the additional runoff would occur at a time when some basins, particularly in Northern California, are being recharged at their maximum capacity.

Where precipitation is projected to increase in California, the increases are focused in Northern California. However, various California climate models provide mixed results regarding changes in total annual precipitation in the State through the end of this century; therefore, no conclusion on an increase or decrease can be made. Considerable uncertainties about the precise effects of climate change on California hydrology and water resources will remain until there is more precise and consistent information about how precipitation patterns, timing, and intensity will change.[8]

The City of Larkspur receives its water supply from the Marin Municipal Water District (MMWD) which serves central and southern Marin County. The residents of southern and central Marin are served by a unique water supply system. MMWD obtains 75 percent of the water consumed annually from rainfall collected in seven reservoirs in Marin. Five of the reservoirs are on the Mount Tamalpais Watershed and the other two are located in West Marin. The remaining 25 percent of their water comes from the Russian River in Sonoma County under a contract with the Sonoma County Water Agency.[9]

(3) Sea Level Rise. Rising sea level is one of the major areas of concern related to global climate change. Two of the primary causes for a sea level rise are the thermal expansion of ocean waters (water expanding as it heats up) and the addition of water to ocean basins by the melting of land-based ice. From 1961 to 2003, global average sea level rose at an average rate of 0.07 inches per year, and at an accelerated average rate of about 0.12 inches per year during the last decade of this

[7] California Climate Change Center, 2006, op. cit.

[8] California, State of, 2006. Department of Water Resources, *Progress on Incorporating Climate Change into Management of California's Water Resources*. July.

[9] Marin Municipal Water District, 2012. Current Sources. Website: marinwater.org/controller?action=menuclick&id=221.

period (1993 to 2003).[10] Over the past 100 years, sea levels along California's coasts and estuaries have risen about 7 inches.[11] An additional discussion of sea level rise is provided in Section IV.H, Hydrology and Water Quality.

(4) Water Quality. Water quality depends on a wide range of variables such as water temperature, flow, runoff rates and timing, waste discharge loads, and the ability of watersheds to assimilate wastes and pollutants. Climate change could alter water quality in a variety of ways, including higher winter flows that reduce pollutant concentrations (through dilution) or increase erosion of land surfaces and stream channels, leading to higher sediment, chemical, and nutrient loads in rivers. Water temperature increases and decreased water flows can result in increasing concentrations of pollutants and salinity. Increases in water temperature alone can likely to lead to adverse changes in water quality, even in the absence of changes in precipitation.

Land and resource use changes can have impacts on water quality comparable to or even greater than those from global climate change. The net effect on water quality for rivers, lakes, and groundwater in the future is dependent not just on climate conditions, but also on a wide range of other human actions and management decisions.

Fortunately, there are a number of stewardship actions that cities and counties can take that reduce costs and improve the reliability and quality of water resources. The City of Larkspur's Climate Action Plan (CAP) has identified several programs to improve water quality, which the City is working to implement through the City's CAP.[12]

(5) Public Health. Global climate change is anticipated to result in not only changes to average temperature, but also to more extreme heat events.[13] These extreme heat events increase the risk of death from dehydration, heart attack, stroke, and respiratory distress, especially with people who are ill, children, the elderly, and the poor, who may lack access to air conditioning and medical assistance. According to the California Climate Change Center, more research is needed to understand the effects of higher temperatures and how adapting to these temperatures can minimize health effects.[14]

c. Emissions Sources and Inventories. An emissions inventory that identifies and quantifies the primary human-generated sources and sinks of GHGs is a well-recognized and useful tool for addressing climate change. This section summarizes the latest information on global, United States, California, local GHG emission inventories, and the GGRP inventory.

(1) Global Emissions. Worldwide emissions of GHGs in 2004 were 30 billion tons of CO_2e per year (including both ongoing emissions from industrial and agricultural sources, but excluding

[10] California, State of, 2008. California Energy Commission's Public Interest Energy Research Program. *The Future is Now: An Update on Climate Change Science, Impacts, and Response Options for California.* September.

[11] Ibid.

[12] Larkspur, City of, 2010. *Climate Action Plan.* June.

[13] California Climate Change Center, 2006, op. cit.

[14] Ibid.

emissions from land-use changes).[15] Global estimates are based on country inventories developed as part of programs of the United Nations Framework Convention on Climate Change (UNFCCC).

(2) U.S. Emissions. In 2010, the United States emitted about 1,633.2 million metric tons of CO_2e with each individual at home releasing approximately 4 metric tons per year. Of the four major sectors nationwide – residential, commercial, industrial and transportation – transportation accounts for the highest amount of GHG emissions (approximately 35 to 40 percent); these emissions are entirely generated from direct fossil fuel combustion. Between 1990 and 2009, total U.S. GHG emissions rose by 7.3 percent, but from emissions decreased from 2008 to 2009 by 6.1 percent. This decrease was primarily due to (1) a decrease in economic output resulting in a decrease in energy consumption across all sectors; and (2) a decrease in the carbon intensity of fuels used to generate electricity due to fuel switching as the price of coal increased, and the price of natural gas decreased significantly. Since 1990, U.S. emissions have increased at an average annual rate of 0.4 percent.[16]

(3) State of California Emissions. According to the California Air Resources Board (CARB) emission inventory estimates, California's gross GHG emissions decreased 1.5 percent, from 463.6 MMT[17] of CO_2e emissions in 2000 to 456.8 million in 2009, with a maximum of 488.8 million in 2007.[18] During the same period, California's population grew by 9.1 percent, from 33.9 to 37.2 million people and GHG emissions per person decreased from 13.7 to 12.4 metric tons of CO_2e per person. The year 2009 saw a 5.8 percent decrease in Statewide GHG emissions, driven by a noticeable drop in on-road transportation, cement production, and electricity. The year 2009 also reflects the full effects of the economic recession and higher fuel prices. As the economy recovers, GHG emissions are likely to rise again without other mitigation actions.

The California EPA Climate Action Team stated in its March 2006 report[19] that the composition of gross climate change pollutant emissions in California in 2002 (expressed in terms of CO_2e) was as follows:

- Carbon dioxide (CO_2) accounted for 83.3 percent;
- Methane (CH_4) accounted for 6.4 percent;
- Nitrous oxide (N_2O) accounted for 6.8 percent; and
- Fluorinated gases (HFCs, PFC, and SF_6) accounted for 3.5 percent.[20]

[15] United Nations Framework Convention on Climate Change, 2007. *Sum of Annex I and Non-Annex I Countries Without Counting Land-Use, Land-Use Change and Forestry (LULUCF)*. Website: unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php

[16] U.S. Environmental Protection Agency, 2011. *The U.S. Greenhouse Gas Emissions and Sinks: Fast Facts*. Website: www.epa.gov/climatechange/emissions/usinventoryreport.html.

[17] A metric ton is equivalent to approximately 1.1 tons.

[18] California Air Resources Board, 2011. *Trends in California GHG Emissions for 2000 to 2009 by Category as Defined in the Scoping Plan*. Website: www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-09_trends.pdf (accessed June 2012). December.

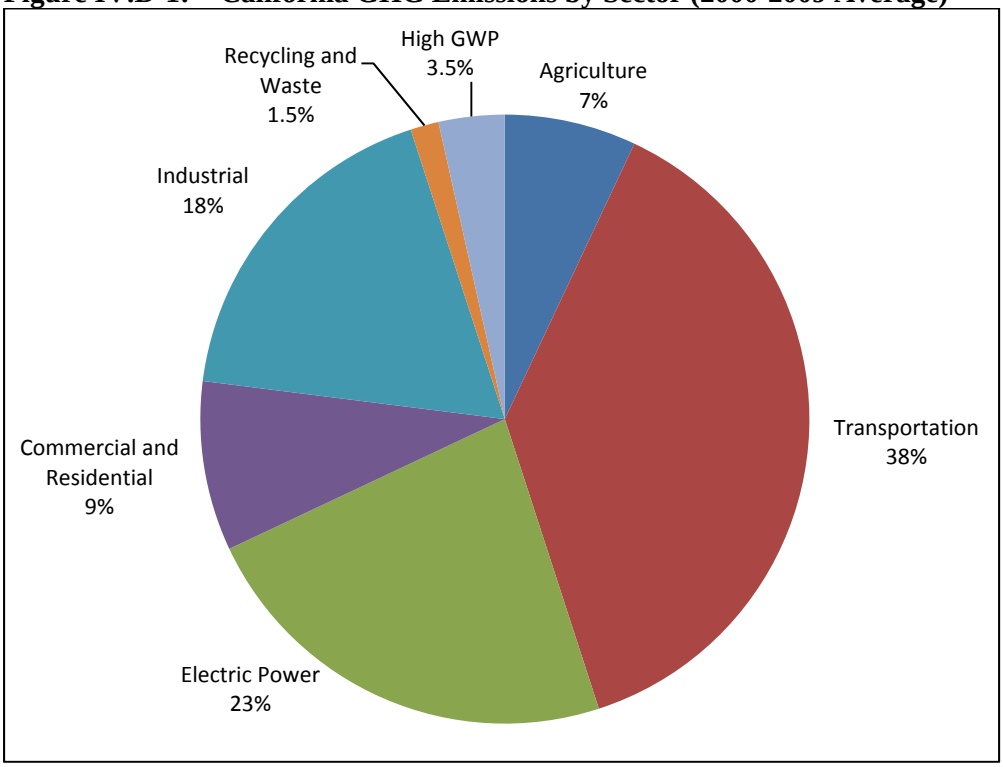
[19] California Environmental Protection Agency, 2006. *Climate Action Team Report to Governor Schwarzenegger and the Legislature*. Website: www.climatechange.ca.gov/climate_action_team/reports/#2006 (accessed July 2012). March.

[20] Ibid.

California has the fourth lowest per-capita CO_2 emission rate from fossil fuel combustion in the country, due to the success of its energy efficiency and renewable energy programs and commitments that have lowered the State's GHG emissions rate of growth by more than half of what it would have been otherwise.[21]

CARB is responsible for developing the California Greenhouse Gas Emission Inventory. This inventory estimates the amount of GHGs emitted to and removed from the atmosphere by human activities within the State of California and supports the AB 32 Climate Change Program, discussed below. CARB's current GHG emission inventory for the years 2000 to 2009 are shown in Figure IV.D-1 according to categories as defined by CARB. The emission inventory estimates are based on the actual amount of all fuels combusted in the State, which accounts for over 85 percent of the GHG emissions within California.

Figure IV.D-1: California GHG Emissions by Sector (2000-2009 Average)



Note: The High GWP sector encompasses miscellaneous sources.

Source: CARB, 2011. *Trends in California GHG Emissions for 2000 to 2009 – by Category as Defined in the Scoping Plan*. Website: www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-08_2010-05-12.pdf. December.

[21] California Energy Commission, 2007. *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004 – Final Staff Report, publication # CEC-600-2006-013-SF*, Sacramento, CA. December 22, 2006, and January 23, 2007, update to that report.

CARB staff has projected 2020 unregulated GHG emissions, which represent the emissions that would be expected to occur in the absence of any GHG reduction actions. CARB staff estimates the State-wide 2020 unregulated GHG emissions will be 596 million metric tons (MMT) of CO_2e. GHG emissions in 2020 from the transportation and electricity sectors as a whole are not expected to increase, but remain at approximately 38 percent and 23 percent of total CO_2e emissions, respectively. The industrial sector consists of large stationary sources of GHG emissions and the percentage of the total 2020 emissions is projected to be 17 percent of total CO_2e emissions. The remaining sources of GHG emissions in 2020 are high global warming potential gases at 8 percent, residential and commercial activities at 8 percent, agriculture at 5 percent, and recycling and waste at 1 percent.[22]

(4) Bay Area Emissions Inventory. The BAAQMD established a climate protection program in 2005 to acknowledge the link between climate change and air quality. The BAAQMD regularly prepares inventories of criteria and toxic air pollutants to support planning, regulatory and other programs. The most recent emissions inventory estimates GHG emissions produced in the San Francisco Bay Area in 2007.[23] The inventory, which was published February 2010, updates the BAAQMD's previous GHG emission inventory for base year 2002.

According to the BAAQMD, in 2007, 95.8 million metric tons of CO_2e of GHGs were emitted by the nine-county San Francisco Bay Area. The transportation sector, including on-road motor vehicles, locomotives, ships and boats, and aircraft, and the industrial/commercial sector (excluding electricity and agriculture) are the largest sources of GHG emissions, each contributing about 36 percent of the region's total CO_2e emissions in the Bay Area. Energy production activities such as electricity generation and co-generation were the third largest contributor with 16 percent of the total GHG emissions. Off-road equipment such as construction, industrial, commercial, and lawn and garden equipment contributed 3 percent of GHG emissions. The contribution from residential fuel usage, primarily from space heating, cooking and water heating, contributed 7 percent of the total GHG emissions. Agriculture and farming activities was the smallest sector with 1 percent of the total GHG emissions in the Bay Area. The Bay Area GHG emissions by sector for the year 2007 are shown in Figure IV.D-2.

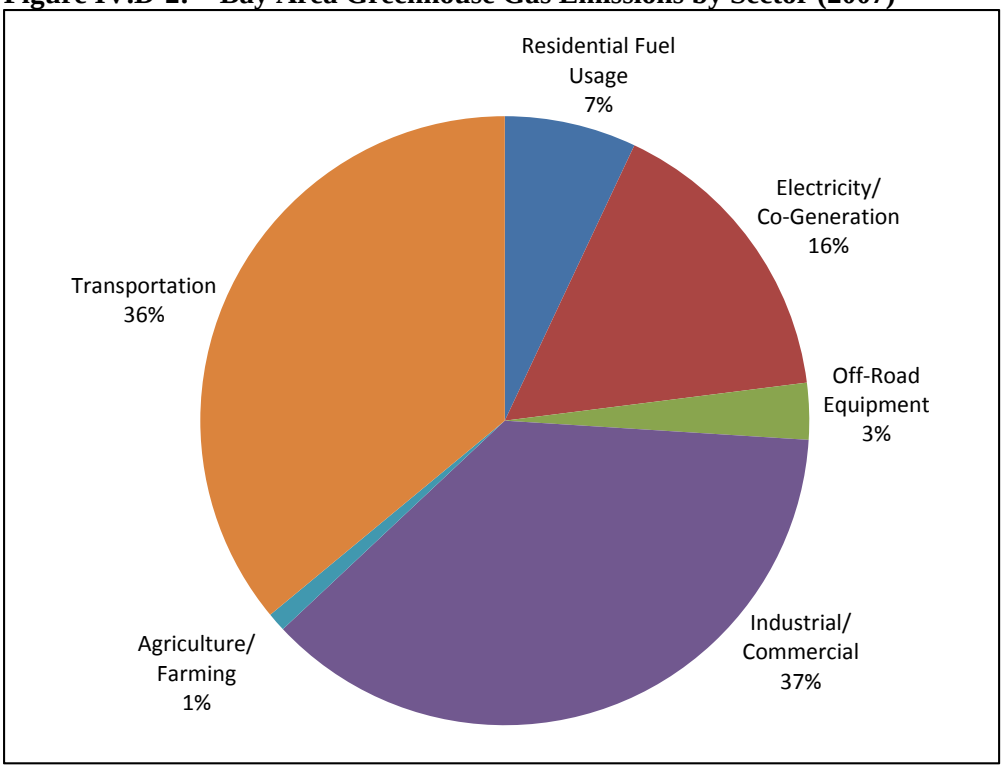
(5) City of Larkspur Emissions. The City of Larkspur recognizes that local governments play a strong role in reducing GHG emissions and mitigating the potential impacts of climate change. In June of 2010, the City of Larkspur approved a CAP to develop strategies that the City's government operations and the community can take to reduce GHG emissions and mitigate, to the extent feasible at the local level, the potential impacts of climate change. Through actions outlined in the CAP, such as increasing energy efficiency of buildings, encouraging less dependence on the automobile, and using clean, renewable energy sources, the community can experience lower energy bills, improved air quality, reduced emissions, and an enhanced quality of life.[24]

[22] California Air Resources Board, 2008. Website: www.climatechange.ca.gov/inventory/index.html. September.

[23] Bay Area Air Quality Management District, 2010. *Source Inventory of Bay Area Greenhouse Gas Emissions*. February.

[24] Larkspur, City of, 2010, op. cit.

Figure IV.D-2: Bay Area Greenhouse Gas Emissions by Sector (2007)



Source: BAAQMD, 2010. *Inventory of Bay Area Greenhouse Gas Emissions.* February.

The CAP also proposed an emissions reduction target. In July, 2010, the City of Larkspur established a Greenhouse Gas Emissions Reduction Target of 15 percent below 2005 levels by 2020, which is consistent with the State's direction to local governments in the AB 32 Scoping Plan. The first step toward reducing GHG emissions is to identify sources of emissions and establish baseline levels. In June 2009, the City of Larkspur completed, and the City Council adopted, Larkspur's 2005 Greenhouse Gas Emissions Inventory. The inventory identifies the sources and quantifies the volumes of GHG emissions resulting from governmental operations as well as activities and operations taking place throughout the community of Larkspur in 2005. The year 2005 is used rather than an earlier or later baseline year due to the more comprehensive and accurate data available for that year. Larkspur's 2005 Greenhouse Gas Emissions Inventory identified the following key findings:[25]

- Emissions from Government Operations
  - Larkspur's government operations produced approximately 540 metric tons of CO_2e in 2005, which is 0.5 percent of total community emissions.
  - The employee commute sector was the greatest source of government operations GHG emissions in 2005 – producing 214 metric tons of CO_2e, or 39.7 percent of total government operations emissions.

[25] Ibid.

- The vehicle fleet sector was the second greatest source of government operations emissions, producing 120 metric tons of CO_2e, or 22.2 percent of total government operations emissions.

- Community-Wide Emissions
  - Larkspur's community produced approximately 106,222 metric tons of CO_2e in 2005.
  - The transportation sector was the greatest source of community GHG emissions in 2005 – producing 63,055 metric tons of CO_2e, or 59.4 percent of total community emissions.
  - Within the transportation sector, 58.2 percent of emissions are produced from travel on State Highway 101 as it passes through Larkspur's jurisdictional boundaries, which also traverses the SMART Station Area Plan area. The remaining 41.8 percent, or 26,347 metric tons of CO_2e, are produced during travel on local roads including regional route Sir Francis Drake Boulevard.
  - The residential sector produced 23,746 metric tons of CO_2e of GHG emissions in 2005, or 22.4 percent of total community emissions.

The City of Larkspur is committed to implementing the CAP in order to mitigate the effects of climate change. The City intends to monitor progress towards achieving the approved emissions reduction target and if needed, plans to update the CAP based on the results from the monitoring.

d. Regulatory Framework. The federal and State regulatory framework related to GHG emissions is described below.

(1) Federal Regulations. The United States has historically had a voluntary approach to reducing GHG emissions. However, on April 2, 2007, the United States Supreme Court ruled that the Environmental Protection Agency (EPA) has the authority to regulate CO_2 emissions under the federal Clean Air Act (CAA). While there currently are no adopted federal regulations for the control or reduction of GHG emissions, the EPA commenced several actions in 2009 that are required to implement a regulatory approach to global climate change, including the ones described below.

On September 22, 2009, EPA issued a final rule for mandatory reporting of GHGs from large GHG emission sources in the United States. In general, this national reporting requirement will provide the EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons or more of CO_2 per year. This publically available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial GHGs along with vehicle and engine manufactures will report at the corporate level. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this rule.

On December 7, 2009, the EPA Administrator signed a final action under the CAA, finding that six GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6) constitute a threat to public health and welfare, and that the combined emissions from motor vehicles cause and contribute to global climate change. This EPA action does not impose any requirements on industry or other entities. However, the findings are a prerequisite to finalizing the GHG emission standards for light-duty vehicles mentioned below. EPA received ten petitions challenging this determination. On July 29, 2010, EPA denied these petitions.

On April 1, 2010, the EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced a final joint rule to establish a national program consisting of new standards for model year 2012 through 2016 light-duty vehicles that will reduce GHG emissions and improve fuel economy. EPA is finalizing the first-ever national GHG emissions standards under the CAA, and NHTSA is finalizing Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act. The EPA GHG standards require light-duty vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile in model year 2016, equivalent to 35.5 miles per gallon.

In December 2010, the EPA issued its plan for establishing GHG pollution standards under the CAA in 2011. The agency looked at a number of sectors and is moving forward on GHG standards for fossil fuel power plants and petroleum refineries – two of the largest industrial sources, representing nearly 40 percent of the GHG pollution in the United States.[26]

On August 9, 2011, EPA and the NHTSA announced the first-ever standards to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses. The final combined standards of the Heavy-Duty National Program will reduce CO_2 emissions by about 270 MMT and save about 530 million barrels of oil over the life of vehicles built for the 2014 to 2018 model years. The heavy duty sector addressed in the EPA and NHTSA rules (including the largest pickup trucks and vans, semi-trucks, and all types and sizes of work trucks and buses in between) accounts for nearly 6 percent of all U.S. GHG emissions and 20 percent of transportation emissions. In addition, air quality will continue to improve as less fuel use leads to reduced ozone and particulate matter.

(2) State Regulations. The CARB is typically the lead agency for implementing climate change regulations in the State. There are many regulations and statutes in California that address both directly and indirectly, GHG emissions, such as renewable portfolio standards (SB 1078, SB 107, SB 2[1X]) and energy efficiency standards (Title 24, Cal. Code Regs.). Many of the most prominent state regulatory activities addressing specifically climate change and GHG emissions are discussed below.

Assembly Bill 1493 (2002). In a response to the transportation sector's significant contribution to California's CO_2 emissions, AB 1493 (Pavley) was enacted on July 22, 2002. AB 1493 requires the CARB to set GHG emission standards for passenger vehicles and light duty trucks (and other vehicles whose primary use is noncommercial personal transportation in the State) manufactured in 2009 and all subsequent model years. These standards (starting in model years 2009 to 2016) were approved by the CARB in 2004, but the needed waiver of Clean Air Act Preemption was not granted by the EPA until June 30, 2009. The CARB responded by amending its original regulation, now referred to as Low Emission Vehicle III GHG, to take effect for model years starting in 2017 to 2025.[27]

Executive Order S-3-05 (2005). Governor Arnold Schwarzenegger signed Executive Order S-3-05 on June 1, 2005, which proclaimed that California is vulnerable to the impacts of climate change. To combat those concerns, the executive order established California's GHG emissions reduction targets, which established the following goals:

[26] U.S. Environmental Protection Agency, 2010. Press Release. December 23.

[27] California Air Resources Board, 2010. California Clean Car Standards – Pavely, Assembly Bill 1493. Website: arb.ca.gov/cc/ccms/ccms.htm (accessed November 2011).

- Greenhouse gas emissions should be reduced to 2000 levels by 2010;
- Greenhouse gas emissions should be reduced to 1990 levels by 2020; and
- Greenhouse gas emissions should be reduced to 80 percent below 1990 levels by 2050.

The Secretary of the California Environmental Protection Agency (CalEPA) is required to coordinate efforts of various State agencies in order to collectively and efficiently reduce GHGs. A biannual progress report must be submitted to the Governor and State Legislature disclosing the progress made toward GHG emission reduction targets. In addition, another biannual report must be submitted illustrating the impacts of global warming on California's water supply, public health, agriculture, the coastline, and forestry, and report possible mitigation and adaptation plans to address these impacts.

Assembly Bill 32 (2006), California Global Warming Solutions Act. California's major initiative for reducing GHG emissions is AB 32, passed by the State legislature on August 31, 2006. This effort aims at reducing GHG emissions to 1990 levels by 2020. The CARB has established the level of GHG emissions in 1990 at 427 MMT CO_2e. The emissions target of 427 MMT requires the reduction of 169 MMT from the State's projected business-as-usual 2020 emissions of 596 MMT. AB 32 requires the CARB to prepare a Scoping Plan that outlines the main State strategies for meeting the 2020 deadline and to reduce GHGs that contribute to global climate change. The Scoping Plan was approved by the CARB on December 11, 2008, and includes measures to reduce GHG emissions related to energy efficiency, water use, recycling, solid waste, and other sources.[28] The Scoping Plan includes a range of GHG reduction actions that may include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system. The Scoping Plan, even after CARB approval, remains a recommendation. The measures in the Scoping Plan will not be binding until after they are adopted through the normal rulemaking process. The CARB rulemaking process includes preparation and release of each of the draft measures, public input through workshops, and a public comment period, followed by a CARB hearing and rule adoption.

In addition to reducing GHG emissions to 1990 levels by 2020, AB 32 directed the CARB and the newly created Climate Action Team (CAT) to identify a list of "discrete early action GHG reduction measures" that could be adopted and made enforceable by January 1, 2010. On January 18, 2007, Governor Schwarzenegger signed Executive Order S-1-07, further solidifying California's dedication to reducing GHGs by setting a new Low Carbon Fuel Standard. The Executive Order sets a target to reduce the carbon intensity of California transportation fuels by at least 10 percent by 2020 and directs the CARB to consider the Low Carbon Fuel Standard as a discrete early action measure.

In June 2007, the CARB approved a list of 37 early action measures, including three discrete early action measures (Low Carbon Fuel Standard, Restrictions on GWP Refrigerants, and Landfill CH_4 Capture).[29] Discrete early action measures are measures that were required to be adopted as regulations and made effective no later than January 1, 2010, the date established by Health and Safety Code

[28] California Air Resources Board, 2008. *Climate Change Scoping Plan: a framework for change*. December.

[29] California Air Resources Board, 2007. *Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California Recommended for Board Consideration*. October. The Low Carbon Fuel Standard has been the subject of litigation in federal court that is still pending.

Section 38560.5. The CARB adopted additional early action measures in October 2007 that tripled the number of discrete early action measures. These measures relate to truck efficiency, port electrification, reduction of PFCs from the semiconductor industry, reduction of propellants in consumer products, proper tire inflation, and SF6 reductions from the non-electricity sector. The combination of early action measures is estimated to reduce State-wide GHG emissions by nearly 16 MMT.[30]

To assist public agencies in analyzing the effects of GHGs under CEQA, Senate Bill 97 (Chapter 185, 2007) required the Governor's Office of Planning and Research (OPR) to develop CEQA guidelines on how to minimize and mitigate a project's GHG emissions. On December 30, 2009, the Natural Resources Agency adopted amendments to the *CEQA Guidelines* related to climate change. These amendments became effective on March 18, 2010.

In December 2008, CARB adopted its Climate Change Scoping Plan, which contains the main strategies California will implement to achieve reduction of approximately 169 MMT of CO_2e, or approximately 30 percent from the State's projected 2020 emission level of 596 MMT of CO_2e under a business-as-usual scenario (this is a reduction of 42 MMT CO_2e, or almost 10 percent from 2002-2004 average emissions). The Scoping Plan also includes CARB-recommended GHG reductions for each emissions sector of the State's GHG inventory. The Scoping Plan calls for the largest reductions in GHG emissions to be achieved by implementing the following measures and standards:

- Improved emissions standards for light-duty vehicles (estimated reductions of 31.7 MMT CO_2e);
- The Low-Carbon Fuel Standard (15.0 MMT CO_2e);
- Energy efficiency measures in buildings and appliances and the widespread development of combined heat and power systems (26.3 MMT CO_2e); and
- A renewable portfolio standard for electricity production (21.3 MMT CO_2e).

The Scoping Plan identifies 18 emission reduction measures that address cap-and-trade programs, vehicle gas standards, energy efficiency, low carbon fuel standards, renewable energy, regional transportation-related GHG targets, vehicle efficiency measures, goods movement, solar roof programs, industrial emissions, high speed rail, green building strategies, recycling, sustainable forests, water, and air. The measures would result in a total reduction of 174 MMT CO_2e by 2020.

On August 24, 2011, CARB unanimously approved both CARB's new supplemental assessment and re-approved its Scoping Plan, which provides the overall roadmap and rule measures to carry out AB 32. CARB also approved a more robust CEQA equivalent document supporting the supplemental analysis of the cap-and-trade program. CARB also announced that it would be delaying the date that entities would be required to comply with its cap-and-trade program, which was initiated in January, 2012.

CARB has not yet determined what amount of GHG reductions it recommends from local government operations; however, the Scoping Plan states that land use planning and urban growth decisions will

[30] California Air Resources Board, 2007. "ARB approves tripling of early action measures required under AB 32" News Release 07-46. Website: www.arb.ca.gov/newsrel/nr102507.htm. October 25.

play an important role in the State's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions (meanwhile, CARB is also developing an additional protocol for community emissions). CARB further acknowledges that decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emission sectors. The Scoping Plan states that the ultimate GHG reduction assignment to local government operations is to be determined. With regard to land use planning, the Scoping Plan expects an approximately 5.0 MMT CO_2e reduction due to implementation of SB 375, which is discussed further below.

Senate Bill 1368 (2006). SB 1368 is the companion bill of AB 32 and was signed by Governor Schwarzenegger in September 2006. SB 1368 requires the California Public Utilities Commission (PUC) to establish a GHG emission performance standard for baseload generation from investor-owned utilities and local publicly-owned utilities These standards cannot exceed the GHG emission rate from a baseload combined-cycle natural gas fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the PUC.

Executive Order S-1-07. Executive Order S-1-07 in 2007 indicates that the transportation sector accounts for over 40 percent of Statewide GHG emissions and establishes a goal to reduce the carbon intensity of transportation fuels sold in California by a minimum of 10 percent by 2020.

Senate Bill 97 (2007). SB 97, signed by the Governor in August 2007 (Chapter 185, Statutes of 2007; Public Resources Code, Sections 21083.05 and 21097), acknowledges climate change is a prominent environmental issue that requires analysis under CEQA. This bill directed the OPR to prepare, develop, and transmit to the California Natural Resources Agency guidelines for mitigating GHG emissions or the effects of GHG emissions, as required by CEQA.

The California Natural Resources Agency adopted the amendments to the *CEQA Guidelines* in January 2010, which went into effect in March 2010. The amendments do not identify a threshold of significance for GHG emissions, nor do they prescribe assessment methodologies or specific mitigation measures. The amendments encourage lead agencies to consider many factors in performing a CEQA analysis, but preserve the discretion granted by CEQA to lead agencies in making their own determinations based on substantial evidence. The amendments also encourage public agencies to make use of programmatic mitigation plans and programs when they perform individual project analyses.

Senate Bill 375 (2008). Signed into law on October 1, 2008, SB 375 supplements GHG reductions from new vehicle technology and fuel standards with reductions from more efficient land use patterns and improved transportation. Under the law, CARB approved GHG reduction targets in February 2011 for California's 18 federally designated regional planning bodies, known as Metropolitan Planning Organizations (MPOs). CARB may update the targets every 4 years and must update them every 8 years. MPOs in turn must demonstrate how their plans, policies and transportation investments meet the targets set by CARB through Sustainable Community Strategies (SCS). The SCS are included with the Regional Transportation Plan (RTP), a report required by State law. However, if an MPO finds that their SCS will not meet the GHG reduction target, they may prepare an Alternative Planning Strategy (APS). The APS identifies the impediments to achieving the targets.

Executive Order S-13-08. Governor Schwarzenegger signed Executive Order S-13-08 on November 14, 2008, which directs California to develop methods for adapting to climate change through preparation of a Statewide plan. The executive order directed OPR, in cooperation with the California Natural Resources Agency, to provide land use planning guidance related to sea level rise and other climate change impacts by May 30, 2009.

Office of Planning and Research. On December 30, 2009, the California Natural Resources Agency adopted amendments to the *CEQA Guidelines* related to Climate Change. These amendments became effective on March 18, 2010. Revisions to Appendix G of the CEQA Guidelines suggest that development projects be evaluated based on the following thresholds:

- Would the project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; and
- Would the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs.

(3) Bay Area Air Quality Management District. BAAQMD is the regional government agency that regulates sources of air pollution with the nine San Francisco Bay Area counties. The BAAQMD regulates GHG emissions through the following plans, programs, and guidelines.

Regional Clean Air Plans. BAAQMD and other air districts prepare clean air plans in accordance with the State and federal Clean Air Acts. The Bay Area 2010 Clean Air Plan (Bay Area 2010 CAP) provides a comprehensive plan to improve Bay Area air quality and protect public health through implementation of a control strategy designed to reduce emissions and decrease ambient concentrations of harmful pollutants. The most recent Bay Area 2010 CAP also includes measures designed to reduce GHG emissions.

Bay Area Air Quality Management District Climate Protection Program. The 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 climate protection program includes measures that promote energy efficiency, reduce vehicle miles traveled, and develop alternative sources of energy, all of which assist in reducing emissions of GHG and in reducing air pollutants that affect the health of residents. BAAQMD also seeks to support current climate protection programs in the region and to stimulate additional efforts through public education and outreach, technical assistance to local governments and other interested parties, and promotion of collaborative efforts among stakeholders.

BAAQMD CEQA Air Quality Guidelines. The BAAQMD adopted revised *CEQA Air Quality Guidelines* on June 2, 2010 and then adopted a modified version of the Guidelines in May, 2011. The BAAQMD *CEQA Air Quality Guidelines* include thresholds of significance for GHG emissions.[31] Under the latest *CEQA Air Quality Guidelines*, a local government may prepare a Qualified

[31] On March 5, 2012, the Alameda County Superior Court issued a judgment finding that the BAAQMD had failed to comply with CEQA when it adopted the thresholds of significance in the 2011 BAAQMD CEQA Air Quality Guidelines. The court issued a writ of mandate ordering the BAAQMD to set aside the thresholds and cease dissemination of them until the BAAQMD complied with CEQA. In view of the court's order, the BAAQMD is no longer recommending that the thresholds of significance be used as a generally applicable measure of a project's significant air quality impacts.

Greenhouse Gas Reduction Strategy that is consistent with AB 32 goals. If a project is consistent with an adopted Qualified Greenhouse Gas Reduction Strategy and General Plan that addresses the project's GHG emissions, it can be presumed that the project will not have significant GHG emissions under CEQA.[32] The BAAQMD also adopted a quantitative threshold for project level analyses based on estimated GHG emissions as well as per capita metrics.

e. Larkspur General Plan Policies. The City of Larkspur's 1990 General Plan does not include policies on GHG emissions or global climate change. However, as discussed above, in June 2010, the City of Larkspur approved a CAP to develop strategies that the City's government operations and the community can take to reduce its GHG emissions and mitigate, to the extent feasible at the local level, the potential impacts of climate change. Through actions outlined in the CAP, such as increasing energy efficiency of buildings, encouraging less dependence on the automobile, and using clean, renewable energy sources, the community can experience lower energy bills, improved air quality, reduced emissions, and an enhanced quality of life.

More specifically, the CAP includes recommended programs in each the following areas to achieve GHG emission reductions in the community and government operations:

- natural systems, carbon sequestration and emissions offset;
- land use and transportation;
- green building, energy efficiency and renewable energy;
- waste reduction, recycling, and zero waste; and
- water and wastewater.

2. Impacts and Mitigation Measures

This section evaluates the potential global climate change impacts that could result from implementation of the Station Area Plan. It establishes the thresholds of significance, identifies the methodology used in this section, and then evaluates the impacts associated with the Station Area Plan. Where potentially significant impacts are identified, mitigation measures are recommended as appropriate.

a. Criteria of Significance. Implementation of the SMART Station Area Plan would result in significant impacts on global climate change if it would:

- Conflict with the City's adopted Climate Change Action Plan; or
- Result in operational-related GHG emissions that exceed 4.6 metric tons of CO_2e annually per service population; and
- Result in operation-related GHG emissions that exceed 1,100 metric tons of CO_2e annually.

These significance thresholds were adopted as part of the May 2011 CEQA Air Quality Guidelines. It should be noted that on March 5, 2012, the Alameda County Superior Court issued a judgment finding that the BAAQMD had failed to comply with CEQA when it adopted the thresholds of significance in the BAAQMD CEQA Air Quality Guidelines. The court did not determine whether the thresholds of

[32] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines.* May.

significance were valid on their merits, but found that the adoption of the thresholds was a project under CEQA. The court issued a writ of mandate ordering the BAAQMD to set aside the thresholds and cease dissemination of them until the BAAQMD complied with CEQA. In May of 2012, the BAAQMD filed an appeal of the court's decision, the results of which are currently pending.

Although lead agencies may rely on the 2011 BAAQMD CEQA Air Quality Guidelines for assistance in calculating air pollution emissions, obtaining information regarding the health impacts of air pollutants, and identifying potential mitigation measures, the BAAQMD has been ordered to set aside the thresholds and is no longer recommending that they be used as a general measure of a project's significant air quality impacts. The BAAQMD also recognizes that lead agencies may rely on the previously recommended thresholds of significance contained in its CEQA Air Quality Guidelines adopted in 1999. However, the 1999 CEQA Guidelines do not contain thresholds to determine the significance of GHG emissions.

The court's invalidation of BAAQMD's thresholds presents uncertainty for current project applicants and local agencies regarding proper evaluation of air quality and GHG emissions in CEQA documents. Although reliance on the thresholds is no longer required, local agencies still have a duty to evaluate impacts related to air quality and GHG emissions. In addition, CEQA grants local agencies broad discretion to develop their own thresholds of significance, or to rely on thresholds previously adopted or recommended by other public agencies or experts so long as they are supported by substantial evidence. Accordingly, the City of Larkspur has not adopted its own GHG emission thresholds and will continue to use the BAAQMD's thresholds to evaluate project impacts in order to evaluate the potential effects of the project on global climate change. The City believes that these protective thresholds are appropriate in the context of the size, scale, and location of the project.

The BAAQMD's approach to developing a quantitative threshold of significance for GHG emissions was to identify the emissions level for which a project would not be expected to substantially conflict with existing California legislation and policy adopted to reduce Statewide GHG emissions. According to the BAAQMD CEQA Air Quality Guidelines, if a project would generate GHG emissions above the threshold level, it would be considered to contribute substantially to a cumulative impact, and would be considered significant. The Alameda County Superior Court did not question the science behind the thresholds or their merit. Therefore, the City of Larkspur finds that, despite the court ruling, the science and reasoning contained in the 2011 BAAQMD CEQA Air Quality Guidelines provide the latest state-of-the-art guidance available. For that reason, substantial evidence supports continued use of the 2011 BAAQMD CEQA Air Quality Guidelines and the significance thresholds contained therein.

b. Impacts Analysis. The following section describes global climate change impacts associated with implementation of the Station Area Plan.

(1) Consistency with the City's Climate Change Action Plan. The City of Larkspur developed a CAP knowing that climate change may significantly impact Larkspur's residents and businesses, as well as other communities around the world, and that local governments play a role in reducing GHG emissions and mitigating the potential impacts of climate change.

The CAP consists of strategies that the City and community can take to address climate change. These strategies include increasing building energy efficiency, encouraging less dependence on the automobile, and using clean, renewable energy sources. In tandem with the City's 2005 Greenhouse

Gas Emissions Inventory, the CAP acts as the beginning of an ongoing planning process that includes assessing, planning, mitigating and adapting to climate change. The CAP calls for planners to "Study the Larkspur Landing Circle area and enhance the opportunities presented in the location of the Larkspur Ferry, the Marin Airport, and eventually the SMART train station."

Larkspur's CAP includes specific mitigation measures that government and the community can use to reduce, and encourage the reduction of, GHG emissions. For example, emissions generated from the transportation sector are one of the largest sources of GHG emissions, and transportation and land use development are strongly interrelated. Therefore, the CAP encourages compact, transit-oriented development, increasing walking and biking for local trips, and increasing public transit use in Larkspur. This is accomplished through adopting policies that promote compact and efficient development, orienting new development in close proximity to transit systems and services, educating the public on the health and environmental benefits of walking, cycling, and taking public transit, and providing government agency employees with incentives to use alternatives to single occupant auto commuting. CAP policies also encourage the use of sustainable transportation modes by identifying the needs of the community's pedestrian, bicycle, and mass transit facilities and updating the pedestrian and bicycle plan and investment program for these types of facilities.

Measures to reduce emissions from electricity and natural gas are also identified in the CAP. These include improving energy efficiency in existing commercial and residential buildings, reducing energy use in new commercial and residential buildings, and installing residential and commercial renewable energy systems as well as upgrading City buildings, street lighting, and traffic signals with energy-efficient technologies.

Other measures included in the CAP assist in the reduction of waste and the promotion of recycling and reuse of products to reduce impacts on the environment. The CAP includes a measure to reduce water use in the community by increasing customer education programs on water conservation to meet the growing demand for water.

The Station Area Plan promotes the goals of Larkspur's CAP by including Urban Design Guidelines that encourage more compact, transit-oriented development and provide for improvements to pedestrian and bicycle circulation throughout the Plan area, as well as increasing access to public transportation in order to reduce vehicle miles traveled.

More specifically, the Urban Design Guidelines of the Station Area Plan promote development of multi-modal neighborhood streets in the area to provide access to new development for autos, bicyclists and pedestrians. The guidelines call for new streets to have a minimum roadway width so as to calm traffic and allow for safe access by bicycles, pedestrians and autos. The Urban Design Guidelines also state that additional pedestrian paths should be provided throughout new development areas. These new pedestrian paths allow convenient pedestrian movement within and through the Plan area, making access to transit, services and amenities more convenient. As new development or redevelopment occurs on opportunity sites, the Urban Design Guidelines state that new private streets and lanes will be needed. Guidelines for the new private streets and lanes include: sidewalks for pedestrians along all new streets and accommodations for bicyclists; adequate lighting for pedestrian safety; plantings to ensure visual interest to pedestrians; a landscaped buffer between the streets and lanes and residences; and safe and convenient bike parking at destinations along each route.

The Urban Design Guidelines also include incorporating sustainability features into the Plan area by providing trees and landscaped areas along pedestrian walkways, in parking lots, and in public spaces in the Plan area. The Urban Design Guidelines also identify incorporating low maintenance plantings and stormwater management into landscape design, installing pervious paving where appropriate, utilizing recycled and recyclable materials, and prioritizing pedestrians and cyclists in streetscape treatments.

Opportunity sites within the Plan area will be accessed primarily from Sir Francis Drake Boulevard, Larkspur Landing Circle and Redwood Highway. The Station Area Plan contains design guidelines for Sir Francis Drake Boulevard that include providing sidewalks, where needed, to allow pedestrian access to planned bus transit facilities, and also, where feasible, adding pedestrian amenities to the multi-use trail along the south side of the road to encourage biking and walking. The City of Larkspur intends to continue coordination with other local and regional agencies to pursue possible enhancements to Sir Francis Drake Boulevard that will mitigate potential long-term traffic impacts and improve pedestrian and bicycle circulation.

With regard to Larkspur Landing Circle, the Urban Design Guidelines state that this street is lacking in pedestrian amenities and bicycle lanes. The guidelines for Larkspur Landing Circle include completing missing sidewalks, providing a minimum 6 feet in width within the public right-of-way, and separating the pedestrian walkway from the roadway with a planting strip wherever possible. Also, with future redevelopment of parcels adjacent to the SMART station, the City of Larkspur should consider providing additional pedestrian and bicycle access routes to surrounding destinations.

With the inclusion and implementation of the Urban Design Guidelines, the Station Area Plan would be consistent with the City's CAP. Furthermore, as the Station Area Plan is implemented, new development will be required to comply with the City's Green Building Ordinance, which is also consistent with Larkspur's CAP.

(2) Station Area Plan Greenhouse Gas Emissions. GHG emissions associated with construction and operational activities are described below.

Construction Activities. Construction activities, such as site preparation, site grading, on-site heavy-duty construction vehicles, equipment hauling materials to and from the site, and motor vehicles transporting construction crews would produce combustion emissions from various sources. During construction of projects associated with implementation of the Station Area Plan, GHGs would be emitted through the operation of construction equipment and from worker and builder supply vendor vehicles, each of which typically uses fossil-based fuels to operate. The combustion of fossil-based fuels would create GHGs such as CO_2, CH_4, and N_2O. Furthermore, CH_4 would be emitted during the fueling of heavy equipment.

It is anticipated that development of the opportunity sites would require demolition of existing buildings and hauling of demolished materials. An exact timeline for construction is unknown at this time, however, construction would be expected to occur over a 15- to 20-year period. Using the California Emission Estimator Model (CalEEMod v.2011.1), the total CO_2 emissions associated with construction equipment for implementation of the Station Area Plan would be approximately 20,895 tons CO_2e. Model output sheets are included in Appendix C.

The BAAQMD does not have a numeric threshold to determine the significance of construction emissions. However, specific projects would be required to implement the construction exhaust control measures listed in Mitigation Measure AIR-1 of Section IV.C, Air Quality, including minimization of construction equipment idling and implementation of proper engine tuning and exhaust controls. The mitigation measure would also require contractors to use electric equipment when feasible. These measures would reduce GHG emissions during the construction period to a less-than-significant level.

Operational Greenhouse Gas Emissions. The operational activities associated with implementation of the Station Area Plan could directly or indirectly contribute to the generation of GHG emissions. GHG emissions generated by the Station Area Plan would predominantly consist of CO_2. In comparison to criteria air pollutants (see Section IV.C, Air Quality) such as ozone and PM_{10}, CO_2 emissions persist in the atmosphere for a substantially longer period of time. While emissions of other GHGs, such as CH_4, are important with respect to global climate change, emission levels of other GHGs are less dependent on the land use and circulation patterns associated with the proposed project than are levels of CO_2.

GHG emissions generated from implementation of the Station Area Plan were estimated using the California Emissions Estimator Model v.2011.1.1(CalEEMod), which is the latest computer model for estimating air emissions from land use projects. CalEEMod was developed in cooperation with air districts throughout the State, and is designed as a uniform platform to quantify potential criteria pollutant and GHG emissions associated with construction and operation from a variety of land uses, such as residential and commercial facilities. CalEEMod utilizes widely-accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available. These models and default estimates use sources from the EPA and CARB, as well as studies commissioned by California agencies such as the California Energy Commission and CalRecycle. Project emissions were estimated for energy use, water use, waste generation, and mobile sources, as described below.

Energy and Natural Gas Use. Buildings represent 39 percent of U.S. primary energy use and 70 percent of electricity consumption. Development associated with implementation of the Station Area Plan would increase the demand for electricity and natural gas due to new building space, residents and new employees and would indirectly result in increased GHG emissions from off-site electricity generation at power plants. Electricity and natural gas usage for the project was based on default values in CalEEMod.

Water Use. Water-related energy use consumes 19 percent of California's electricity every year. Energy use and related GHG emissions are based on water supply and conveyance, water treatment, water distribution, and wastewater treatment. Water use rates by land use type were estimated using CalEEMod default water use rate assumptions.

Solid Waste Disposal. The proposed project would also generate solid waste during the operation phase of the project. Solid waste disposal rates are based on default CalEEMod assumptions.

Mobile Sources. Mobile sources (vehicle trips and associated miles traveled) would be the largest emission source of GHGs associated with the proposed project. Transportation is also the largest source of GHG emissions in California and represents approximately 38 percent of annual CO_2 emissions generated in the State. As with most development projects, vehicle miles traveled (VMT) is the most direct indicator of CO_2 emissions from the proposed project and associated CO_2 emissions

function as the best indicator of total GHG emissions. Development associated with implementation of the Station Area Plan would generate an additional 8,284 daily trips over current conditions, with implementation of the Station Area Plan occurring within the next 20 years. Vehicle emissions would decrease with time due to increased regulation of tailpipe emissions; therefore, to provide a conservative analysis of the estimated emissions, this analysis assumes a 2030 build out date. Greenhouse gas emissions associated with the SMART Station Area Plan are shown in Table IV.D-2.

Table IV.D-2: Station Area Plan Greenhouse Gas Emissions

	Emissions (Metric Tons Per Year)				
Emission Source	**CO_2**	**CH_4**	**N_2O**	**CO_2e**	**Percent of Total**
Area Source	687.17	0.66	0.03	710	5
Transportation	7,609.57	0.29	0.13	7,657	54
Water/Wastewater	4,972.61	0.16	0.00	4,976	34
Waste	0.00	21.17	0.00	445	3
Energy	428.90	6.01	0.16	603	4
Total Annual Emissions				**14,391**	

Source: LSA Associates, Inc., 2013.

As shown in Table IV.D-2, the GHG emissions associated with the project would be 14,391 metric tons CO_2e per year, which is above the BAAQMD project level threshold of 1,100 tons per year. To evaluate the project against the service population (SP) criterion, the GHG emission projections are divided by the SP or new employees and residents that would be accommodated in 2030 by the proposed project. If this number is less than 4.6 metric tons CO_2e/SP from all emission sectors, then according to the BAAQMD, the Plan's impact related to GHG emissions would be less than significant.

The proposed project would include 2,033 residents, 468 commercial employees, and 90 hotel employees, for a total service population of 2,591. As shown in Table IV.D-2, the Plan would generate 14,391 metric tons per year of CO_2e, resulting in a 5.5 metric tons per service population GHG emission rate, which is above the BAAQMD project-level threshold of 4.6 metric tons per service population. Therefore the Plan would have a significant impact with respect to GHG emissions or a cumulatively considerable contribution to substantial adverse physical effects on the environment related to global climate change, and mitigation measures would be required. It should be noted that in order to provide the most conservative analysis, the City as Lead Agency decided to use the BAAQMD threshold for *project-level* analysis (i.e., exceedence of 4.6 metric tons of CO_2e per service population annually) per the BAAQMD *CEQA Air Quality Guidelines*. However, if using the BAAQMD thresholds for *program-level* plans – which could include the Station Area Plan – and its annual exceedence of 6.6 metric tons of CO_2e per service population, the Plan would not result in a significant impact.

<u>Impact GCC-1</u>: Implementation of the Station Area Plan could result in GHG emissions that would have a significant impact and cumulatively contribute to global climate change. (S)

When mitigating GHG emissions from land use projects, the BAAQMD recommends incorporating transportation demand management measures to reduce mobile source emissions. One of the key principles to guide future development is to support the planning and implementation of transit-

oriented development densities and multi-modal circulation to support transit ridership; this could, in turn, reduce regional VMT. Transportation modeling completed for the project indicates that average daily traffic would be reduced by 19 percent over typical trip generation rates. The Station Area Plan also incorporates recommended measures for reducing GHG emissions including: mix of land uses, transit service, and bike and pedestrian infrastructure. Plan level land use measures that reduce vehicle miles traveled have been implemented to the extent feasible. The Plan incorporates all of the Plan level transportation emission reduction measures recommended by the BAAQMD such as the mix of uses, locating residential uses near transit, and prioritizing alternate modes of transportation. The following measure would further reduce GHG emissions; however, the impact would remain significant and unavoidable.

> Mitigation Measure GCC-1: To reduce GHG emissions associated with implementation of the Station Area Plan, the Plan shall include a vehicle trip cap and Transportation Demand Management (TDM) program to limit the increase in vehicle trips from the plan area to approximately 10 percent above the existing traffic generated by the site. The City shall monitor the program to measure traffic to ensure that traffic conditions are not worsened by development in the Plan area. Implementation of Mitigation Measure GCC-1would reduce vehicle emissions, however, the reduction in GHG emissions would not reduce impacts to a less-than-significant level. Therefore, this impact would be considered significant and unavoidable. (SU)

(3) Consistency with Plans Adopted for the Purpose of Reducing Greenhouse Gas Emissions. As discussed above, implementation of the Station Area Plan would be consistent with the emission reduction measures outlined in the City of Larkspur's CAP. Additionally, the California Environmental Protection Agency Climate Action Team (CAT) and CARB have developed several reports to achieve the Governor's GHG targets that rely on voluntary actions of California businesses, local government and community groups, and state incentive and regulatory programs. These include the CAT's 2006 "*Report to Governor Schwarzenegger and the Legislature*," CARB's 2007 "*Expanded List of Early Action Measures to Reduce Greenhouse Gas Emissions in California*," and CARB's "*Climate Change Proposed Scoping Plan: a Framework for Change."*

The reports identify strategies to reduce California's emissions to the levels proposed in Executive Order S-3-05 and AB 32 that are applicable to the Station Area Plan. The Proposed Scoping Plan is the most recent document, and the strategies included in the Scoping Plan that apply to the project are contained in Table IV.D-3, which summarizes the extent to which the project complies with the strategies to help California reach the emission reduction targets.

The strategies listed in Table IV.D-3 are either part of the Station Area Plan or would be required under local or State ordinances. As shown in Table IV.D-3, implementation of the Station Area Plan would comply with and would not conflict with or impede implementation of reduction goals identified in AB 32, the Governor's Executive Order S-3-05, and other strategies to help reduce GHGs to the level proposed by the Governor. Further, the BAAQMD set the service population emission threshold at a level at which a Plan would be expected to meet the Statewide emission reduction goals and as shown in Table IV.D-2 above, the project would meet the service population metric established by the BAAQMD.[33] Therefore, implementation of the Station Area Plan would have a less-than-significant impact related to consistency with plans adopted for the purpose of reducing GHG emissions.

[33] Ibid.

Table IV.D-3: Station Area Plan Compliance with Greenhouse Gas Emission Reduction Strategies

Strategy	Station Area Plan Compliance
Energy Efficiency Measures	
Energy Efficiency Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly owned utilities). **Renewables Portfolio Standard** Achieve 33 percent renewable energy mix statewide. **Green Building Strategy** Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.	**Compliant.** Development associated with implementation of the Station Area Plan would be required to comply with the updated Title 24 standards for building construction. Development projects within the Plan area would also be required to comply with the City's Green Building Ordinance, which would contribute to a reduction in the City's carbon footprint.
Water Conservation and Efficiency Measures	
Water Use Efficiency Continue efficiency programs and use cleaner energy sources to move and treat water. Approximately 19 percent of all electricity, 30 percent of all natural gas, and 88 million gallons of diesel are used to convey, treat, distribute and use water and wastewater. Increasing the efficiency of water transport and reducing water use would reduce GHG emissions.	**Compliant.** Any development associated with the Station Area Plan would be required to comply with the requirements of the City's Green Building Ordinance including measures to increase water use efficiency. The Urban Design Guidelines of the Station Area Plan include sustainability practices for streetscape treatments that include a variety of sustainable elements such as landscape design that integrates storm water management.
Solid Waste Reduction Measures	
Increase Waste Diversion, Composting, and Commercial Recycling, and Move Toward Zero-Waste. Increase waste diversion from landfills beyond the 50 percent mandate to provide for additional recovery of recyclable materials. Composting and commercial recycling could have substantial GHG reduction benefits. In the long term, zero-waste policies that would require manufacturers to design products to be fully recyclable may be necessary.	**Compliant.** Development associated with the Station Area Plan would meet the requirements of City policies on waste diversion. The Urban Design Guidelines for the Station Area Plan also provide sustainability guidelines that recommend the utilization of recycled and recyclable materials.

Table IV.D-3: Station Area Plan Compliance with Greenhouse Gas Emission Reduction Strategies

Strategy	Station Area Plan Compliance
Transportation and Motor Vehicle Measures	
Vehicle Climate Change Standards. AB 1493 (Pavley) required the State to develop and adopt regulations that achieve the maximum feasible and cost-effective reduction of GHG emissions from passenger vehicles and light duty trucks. Regulations were adopted by the CARB in September 2004. **Light-Duty Vehicle Efficiency Measures.** Implement additional measures that could reduce light-duty GHG emissions. For example, measures to ensure that tires are properly inflated can both reduce GHG emissions and improve fuel efficiency. **Adopt Heavy- and Medium-Duty Fuel and Engine Efficiency Measures**. Regulations to require retrofits to improve the fuel efficiency of heavy-duty trucks that could include devices that reduce aerodynamic drag and rolling resistance. This measure could also include hybridization of and increased engine efficiency of vehicles. **Low Carbon Fuel Standard.** CARB identified this measure as a Discrete Early Action Measure. This measure would reduce the carbon intensity of California's transportation fuels by at least 10% by 2020.	**Compliant.** The Station Area Plan does not involve the manufacture, sale, or purchase of vehicles. However, vehicles that operate within and access the Plan area would comply with any vehicle and fuel standards that the CARB adopts.
Transportation and Motor Vehicle Measures *(Continued)*	
Regional Transportation-Related Greenhouse Gas Targets. Develop regional GHG emissions reduction targets for passenger vehicles. Local governments will play a significant role in the regional planning process to reach passenger vehicle GHG emissions reduction targets. Local governments have the ability to directly influence both the siting and design of new residential and commercial developments in a way that reduces GHGes associated with vehicle travel.	**Compliant.** Specific regional emission targets for transportation emissions do not directly apply to the Station Area Plan. The proposed project would contribute to an overall reduction in vehicle miles traveled and associated vehicle emissions by prioritizing pedestrians and cyclists, providing residential uses near transit options and by allowing for mixed use development.
Measures to Reduce High Global Warming Potential (GWP) Gases. CARB has identified Discrete Early Action measures to reduce GHG emissions from the refrigerants used in car air conditioners, semiconductor manufacturing, and consumer products. CARB has also identified potential reduction opportunities for future commercial and industrial refrigeration, changing the refrigerants used in auto air conditioning systems, and ensuring that existing car air conditioning systems do not leak**.**	**Compliant.** Products used, sold, or serviced in the Plan area would comply with current and future CARB rules and regulations.

Source: LSA Associates, Inc., 2013.