

# 2.12

## **Greenhouse Gases and Climate Change**

The new millennium has seen Global climate change (GCC) rapidly emerge as one of the most critical and widely debated scientific, economic, and political issues in the United States. The anticipated impacts of climate change on California range from water shortages to inundation from sea level rise. Transportation systems contribute to climate change primarily through greenhouse gas (GHG) emissions from vehicles. In the previous CTP EIRs (1995, 2000 & 2004) a section on GCC and GHG was not included, nor was the issue of GCC even mentioned. Only recently have the CEQA guidelines been amended to include guidance on how to address GHG emissions and the effects of GCC, though the guidance continues to evolve (OPR, 2008b).

This section of the EIR identifies laws, plans and policies that are beginning to address climate change, and describes existing greenhouse gas emissions and warming trends in the area. The section considers how the 2009 CTP would affect emissions of GHGs and the ability of the State of California to achieve the AB-32 requirement of reducing emissions to 1990 levels by the year 2020 (approximately a 30 percent reduction). In addition, the analysis qualitatively describes the potential impacts of climate change – such as sea level rise – on Plan projects themselves and on the regional transportation system.

### **Existing Setting**

#### **GLOBAL CLIMATE CHANGE**

GCC refers to a change in the average air temperature that may be measured by wind patterns, storms, precipitation, and temperature. The baseline by which these changes are measured originates in historical records identifying temperature changes that have occurred in the distant past, such as during previous ice ages. Over the last 10,000 years, the average temperature of the earth has changed slowly over long periods, warmed and then, again over long periods,

cooled. However, scientists have observed an unprecedented increase in the rate of warming over the past 150 years, roughly coinciding with the global industrial revolution.

Although GCC is now widely accepted as a phenomenon, the extent and speed of change to be expected, and the exact contribution from human sources, remains in debate. Furthermore, how *local* land use and development decisions affect GCC is difficult to quantify and therefore is not yet reflected in climate modeling. Nonetheless, the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> — made up of the world’s leading climate scientists — have reached consensus that global climate change is “very likely” caused by humans, and that hotter temperatures and rising sea levels will continue for centuries no matter how much humans control their future emissions. In particular, human influences have:

- *very likely* contributed to sea level rise and increased storm surge during the latter half of the 20th century;
- *likely* contributed to changes in wind patterns, affecting extra-tropical storm tracks and temperature patterns;
- *likely* increased temperatures of extreme hot nights, cold nights and cold days;
- *more likely than not* increased the risk of heat waves, area affected by drought since the 1970s, and frequency of heavy precipitation events. (IPCC, November 2007).

The IPCC predicts that the increase in global mean temperature from 1990-2100 could range from 2.0 to 11.5 degrees Fahrenheit. The same report projects a sea level rise of seven to 23 inches by the end of the century, with a greater rise possible depending on the rate of polar ice sheet melting.

According to the California Climate Action Team, accelerating GCC has the potential to cause a number of adverse impacts in California, including but not limited to: a shrinking Sierra snowpack that would threaten the state’s water supply; public health threats caused by higher temperatures and more smog; damage to agriculture and forests due to reduced water storage capacity, rising temperatures, increasing salt water intrusion, flooding, and pest infestations; critical habitat modification and destruction; eroding coastlines; increased wildfire risk; and increased electricity demand (CCAT, 2006).

While all of these impacts may be felt to some extent in the Bay Area, of particular concern are sea level rise and increased storm surge with the resulting potential for intermittent flooding and gradual inundation; water quality and water supply issues; fire threat at the urban-wildland interface; and an imbalance between electricity supply and demand.

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<sup>1</sup> The Intergovernmental Panel on Climate Change (IPCC) is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP). Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts, and options for adaptation and mitigation.

## GREENHOUSE GASES

Gases that trap heat in the Earth's atmosphere are called greenhouse gases (GHGs). These gases play a critical role in determining the Earth's surface temperature. Part of the solar radiation that enters Earth's atmosphere is absorbed by the Earth's surface, while part is reflected back toward space. GHGs, however, absorb some of the radiation and the greater the prevalence of these gases, the greater the retention of this radiation. The retention of this additional radiation results in a warming of the atmosphere. Some level of GHGs is essential for maintaining temperatures supportive of life on Earth. Without naturally-occurring GHGs, the Earth's surface would be about 61°F cooler (CCAT, 2006). This phenomenon is known as the greenhouse effect. However, many scientists believe that emissions from human activities—such as electricity generation, vehicle emissions, and even farming and forestry practices—have elevated the concentration of GHGs in the atmosphere beyond naturally-occurring concentrations, contributing to the larger process of global climate change. The six primary GHGs are:

- **Carbon Dioxide (CO<sub>2</sub>)**, emitted when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned;
- **Methane (CH<sub>4</sub>)**, produced through the anaerobic decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion;
- **Nitrous oxide (N<sub>2</sub>O)**, typically generated as a result of soil cultivation practices, particularly the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning;
- **Hydrofluorocarbons (HFCs)**, primarily used as refrigerants;
- **Perfluorocarbons (PFCs)**, originally introduced as alternatives to ozone depleting substances (such as HFCs) and typically emitted as by-products of industrial and manufacturing processes; and
- **Sulfur hexafluoride (SF<sub>6</sub>)**, primarily used in electrical transmission and distribution systems.

Though there are other gases that can contribute to global warming, these six are identified explicitly in California legislation and litigation as being of primary concern. GHGs have varying potentials to trap heat in the atmosphere. The potential is typically measured using two parameters: global warming potential (GWP), and atmospheric lifetimes. Measurements of GWP range from 1 for carbon dioxide to 23,900 for sulfur hexafluoride. GHG emissions with a higher GWP have a greater global warming effect on a molecule-by-molecule basis. For example, one ton of CH<sub>4</sub> has the same contribution to the greenhouse effect as approximately 21 tons of CO<sub>2</sub> (California Climate Action Registry, General Reporting Protocol, 2007). GWP is alternatively described as “carbon dioxide equivalents”, or CO<sub>2</sub>e. The second parameter, “at-

atmospheric lifetime” describes how long it takes to restore the system to equilibrium following an increase in the concentration of a GHG in the atmosphere. Atmospheric lifetimes of GHGs range from tens to thousands of years.

### **California and Bay Area GHG Emissions**

GHG emissions contributing to GCC are attributable in large part to human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors (California Energy Commission (CEC 2007, 19). The State of California alone produced almost 500 million metric tons of CO<sub>2</sub>, making California the second largest emitter in the United States after Texas, and about twelfth in the world. Major sources in California include fossil fuel consumption from transportation (38 percent), industry (20 percent), electricity production (25 percent), residential (6 percent) and agricultural (6 percent) sectors (CEC 2007). Much like nations around the world, California government is looking at options and opportunities for drastically reducing GHG emissions with the hope of thereby delaying, mitigating, or preventing at least some of the anticipated impacts of GCC on California communities.

Recently, local and regional agencies in the Bay Area have taken steps to measure, quantify, evaluate, and mitigate their contributions to GHG emissions and global warming. For example, the cities of San Francisco, San Jose, and Palo Alto, the East Bay Municipal Utility District, UC Berkeley and Stanford University, and numerous other water and power utilities, public agencies, foundations, and individual businesses are voluntary members of the Climate Action Registry, a private non-profit organization formed by the State of California in 2001 that serves as a voluntary greenhouse gas (GHG) registry to protect and promote early actions to reduce GHG emissions by organizations. Additionally, a number of cities and counties in the Bay Area — including Alameda County, City of Alameda, Contra Costa County, Marin County, Sonoma County, San Francisco City and County, Berkeley, and Rohnert Park — have recently developed or are in the process of completing their own climate/greenhouse gas reduction action plans and inventories (Office of Planning and Research (OPR), 2008c).

In 2008, the Bay Area Air Quality Management District (BAAQMD) completed a baseline inventory of GHG emissions for the year 2007. According to that inventory, 102 million tons of CO<sub>2</sub>e were emitted in the Bay Area that year (BAAQMD, 2008b). Table 2.12-1 shows the Bay Area GHG emission breakdown by pollutant.

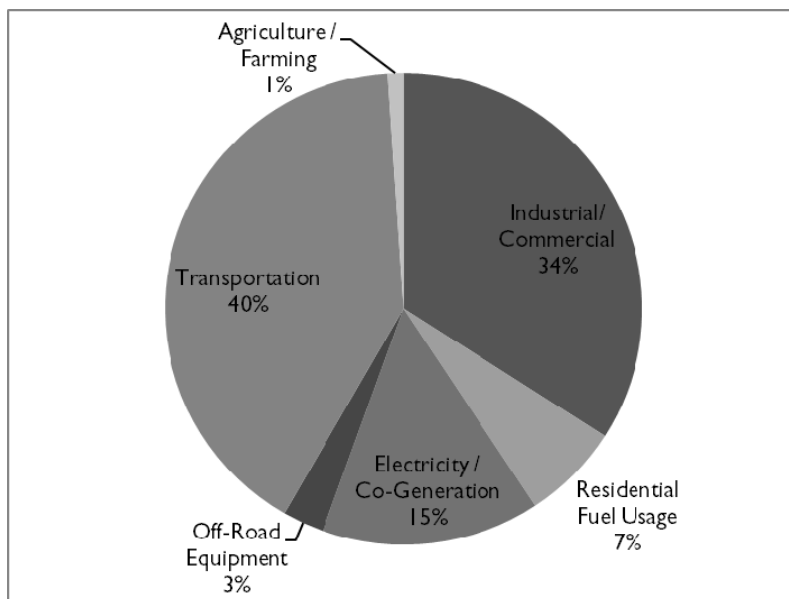
**Table 2.12-1: 2007 Bay Area CO<sub>2</sub>e Emissions by Pollutant**

<i>Pollutant</i>	<i>Percentage</i>	<i>CO<sub>2</sub>e (Million Tons/Year)</i>
Carbon Dioxide	91.4%	93.7
Methane	2.4%	2.5
Nitrous Oxide	2.2%	2.3
HFC, PFC, SF <sub>6</sub>	3.9%	4.0
Total	100%	102.6

Source: Bay Area Quality Management District, 2009

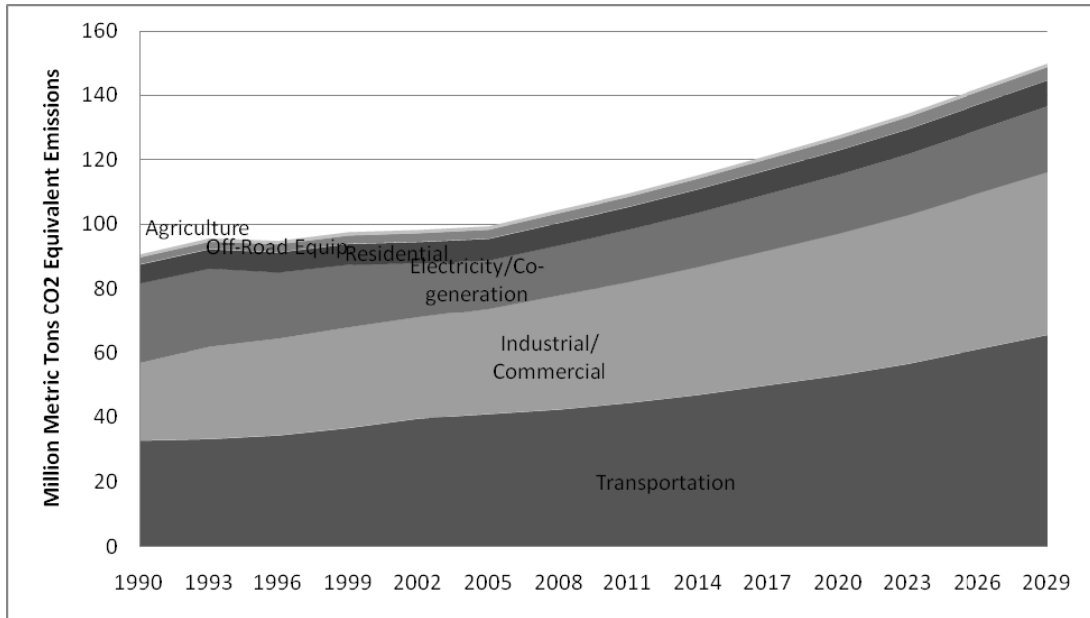
As shown in Chart 2.12-1, in 2007, the Bay Area's transportation sector alone contributed 40 percent of the CO<sub>2</sub>e GHG emissions, followed by industrial and commercial sources (34 percent), electricity and co-generation (15 percent), residential fuel usage (7 percent), off-road equipment (3 percent), and agriculture and farming (1 percent). Bay Area emissions by sector are illustrated in Chart 3.13-1.

Absent any policy changes, the Bay Area's greenhouse gas emissions are expected to grow at a rate of approximately 1.4 percent a year in the future due to population growth and economic expansion (BAAQMD 2008b). Economic activity variations and the fraction of electric power generation in the region will cause year-to-year fluctuations in the emissions trends. Chart 2.12-2 shows the emission trends in CO<sub>2</sub>e by major sources for the period of 1990 to 2029 under "business as usual" conditions. According to the historical emissions data, total CO<sub>2</sub>e has increased from 90.7 in 1990 to 102.6 in 2007, a 14 percent increase, and an annual percentage increase of less than 1 percent.

**Chart 2.12-1: Bay Area Greenhouse Gas Emissions by Sector, as a Percent of Total Emissions**

Source: Bay Area Air Quality Management District, Source Inventory of Bay Area Greenhouse Gas Emissions, 2008b.

**Chart 2.12-2: Bay Area Greenhouse Gas Emissions Trends by Sector**



Source: Bay Area Air Quality Management District, Source Inventory of Bay Area Greenhouse Gas Emissions, 2008b.

**Table 2.12-2: 2005 Greenhouse Gas Emissions in Contra Costa County**

Emissions Source	MTCO <sub>2</sub> e*	Percent of Total Emissions
Energy Use- Residential	1,587,655	13%
Energy Use- Commercial/ Industrial/ Direct Access	6,030,798	49%
Transportation	4,542,073	37%
Landfilled Waste	175,378	1%
<b>TOTAL</b>	<b>12,335,904</b>	<b>100%</b>

\* MTCO<sub>2</sub>e, or metric tons of carbon dioxide equivalent, describes the amount of carbon dioxide that would have the same climate change potential as the actual assortment of greenhouse gases.

Source: Contra Costa County Greenhouse Gas Emissions Inventory Report, June 2008.

In 2008 Contra Costa County completed a greenhouse gas emissions inventory report, which is summarized in Table 2.12-2. This inventory showed that 37 percent of greenhouse gas emissions in Contra Costa County are transportation related.

**SEA LEVEL RISE**

Sea level rise as a consequence of global warming has received considerable attention in the scientific community and the media. It is widely believed that higher global temperatures will lead to higher ocean temperatures and the melting of polar ice caps, both of which in turn will cause global sea levels to rise. Historical records show that sea level in San Francisco Bay has risen 18-20 cm (7 inches) over the past 150 years. A San Francisco Bay Conservation and Development Commission (BCDC) report on climate change and sea level rise around San Francisco

Bay predicts a sea level rise of up to one meter by the year 2100 from global warming (BCDC, 2008). The Commission also produced maps that reflect the low-lying areas of the shoreline that would be subject to tidal inundation and flooding should a one meter sea level rise occur (BCDC, 2008). Sea level rise models indicate that a 30 cm (11.8 inch) rise in sea level would shift the 100-year storm surge-induced flood event to once every 10 years (BCDC, 2008). This event, if it does occur, would have dramatic implications for substantial portions of California's infrastructure and population.

## REGULATORY SETTING

### Federal

#### *Global Change Research Act (1990)*

In 1990, Congress passed and the President signed Public Law 101-606, the Global Change Research Act. The purpose of the legislation was: "...to require the establishment of a United States Global Change Research Program aimed at understanding and responding to global change, including the cumulative effects of human activities and natural processes on the environment, to promote discussions towards international protocols in global change research, and for other purposes." To that end, the Global Change Research Information Office (GCRIO) was established in 1991 (it began formal operation in 1993) to serve as a clearinghouse of information. The Act requires a report to Congress every four years on the environmental, economic, health and safety consequences of climate change; however, the first and only one of these reports to-date, the *National Assessment on Climate Change*, was not published until 2000. In February 2004, operational responsibility for GCRIO shifted to the U.S. Climate Change Science Program.

#### *Massachusetts v. EPA (2007)*

In this U.S. Supreme Court case, 12 states, three cities, and 13 environmental groups filed suit that the U.S. Environmental Protection Agency (EPA) should be required to regulate carbon dioxide and other greenhouse gases as pollutants under the federal Clean Air Act. In April 2007, the U.S. Supreme Court found that the EPA has a statutory authority to formulate standards and regulations to address greenhouse gases, which it historically has not done. To date, the EPA still has not taken any new action. It is unclear what effect the action would take, in particular on California communities as they may already be subject to more stringent regulations.

#### *Energy Independence and Security Act of 2007*

In December 2007, President Bush signed the Energy Independence and Security Act of 2007 to move the U.S. toward greater energy independence and security. This energy bill increases the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS)

requiring fuel producers to use at least 36 billion gallons of biofuel in 2022. It also tightens the Corporate Average Fuel Economy (CAFE) standards that regulate the average fuel economy in the vehicles produced by each major automaker. The current CAFE standard for cars, set in 1984, requires manufacturers to achieve an average of 27.5 miles per gallon, while a new standard for light trucks and heavier SUVs was adopted in 2006 that would require new vehicles to achieve 24 mpg by 2011 (this standard was later challenged in court). This energy bill requires that these standards be increased such that, by 2020, the new cars and light trucks sold each year deliver a combined fleet average of 35 miles per gallon.

## State

### *Assembly Bill 1493 (Chapter 200, Statutes of 2002)*

Assembly Bill (AB) 1493 (Pavley) amended Health and Safety Code sections 42823 and 43018.5 requiring the California Air Resources Board (CARB) to develop and adopt regulations that achieve maximum feasible and cost-effective reduction of GHG emissions from passenger vehicles, light-duty trucks, and other vehicles used for noncommercial personal transportation in California. The regulations prescribed by AB 1493 may not take effect prior to January 1, 2006, and they apply only to 2009 and later model years.

In September 2004, pursuant to AB 1493, the CARB approved regulations to reduce greenhouse gas emissions from new motor vehicles. Under the regulation, one manufacturer fleet average emission standard is established for passenger cars and the lightest trucks, and a separate manufacturer fleet average emission standard is established for heavier trucks. The regulation took effect on January 1, 2006 and set near-term emission standards, phased in from 2009 through 2012, and mid-term emission standards, phased in from 2013 through 2016 (referred to as the Pavley Phase 1 rules). The CARB intends to extend the existing requirements to obtain further reductions in the 2017 to 2020 timeframe (referred to as Pavley Phase 2 rules). However, EPA has refused to grant a waiver that would allow California to implement these standards, and California has challenged this action in federal court. The CARB calculates that in calendar year 2016, the Pavley Phase 1 rules will reduce California's GHG emissions by 16.4 million metric tons of carbon dioxide equivalents, and by 2020, Pavley Phase 2 would reduce emissions by 31.7 million metric tons of carbon dioxide equivalents. Further, the AB 1493 new vehicle requirements would cumulatively produce 45 percent more GHG reductions by 2020 compared to the new federal CAFE standard in the Energy Independence and Security Act of 2007 (above)<sup>2</sup>.

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<sup>2</sup> California Air Resources Board, Comparison of Greenhouse Gas Reductions for the United States and Canada Under ARB GHG Regulations and Proposed Federal 2011-2015 Model Year Fuel Economy Standards, Addendum to February 25 Technical Assessment (2008).

*Executive Order S-3-05 (Gov. Schwarzenegger, June 2005)*

The Governor of California signed Executive Order S-3-05 on June 1, 2005. The Order recognizes California's vulnerability to climate change, noting that increasing temperatures could potentially reduce snow pack in the Sierra Nevada, which is a primary source of the State's water supply. Additionally, according to this Order, climate change could influence human health, coastal habitats, microclimates, and agricultural yield. The Order set the greenhouse gas reduction targets for California: 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. This corresponds to an approximate 27 percent reduction by 2030 to 1990 levels, or 55 CO<sub>2</sub>e in total emissions which correlates to 41 percent reduction over today's levels by 2030.

*California Global Warming Solutions Act of 2006 (AB 32)*

In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Global Warming Solutions Act (Health and Safety Code Section 38500 et. seq.). The Act requires the reduction of statewide total GHG emissions to 1990 levels by the year 2020. This change, which is estimated to be a 25 to 35 percent reduction from current emission levels, will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. The Act also directs CARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources and address GHG emissions from vehicles. CARB has stated that the regulatory requirements for stationary sources will be first applied to electricity power generation and utilities, petrochemical refining, cement manufacturing, and industrial/commercial combustion. The second group of target industries will include oil and gas production/distribution, transportation, landfills and other GHG-intensive industrial processes.

*Senate Bill 97 (Chapter 185, Statutes 2007)*

Senate Bill (SB) 97 directs the Office of Planning and Research (OPR) to prepare, develop, and transmit to the California Resources Agency guidelines for feasible mitigation of GHG emissions or the effects of GHG emissions, by July 1, 2009. The Resources Agency is required to certify and adopt amendments to the Guidelines implementing the California Environmental Quality Act ("CEQA Guidelines") on or before January 1, 2010. These new CEQA Guidelines will provide regulatory guidance on the analysis and mitigation of GHG emissions in CEQA documents. In the interim, the OPR offered informal guidance regarding steps lead agencies should take to address climate change in their CEQA documents (OPR, 2008b).

*California Attorney General Actions*

The California Attorney General's office has taken several actions to ensure that California meets its greenhouse gas reduction targets<sup>3</sup>. Examples of the Office of Attorney General's efforts include suing companies in the power industry and the auto industry for their contributions to global warming and writing letters or submitting oral testimony in over 30 different CEQA environmental review processes for city general plans, county general plans, regional transportation plans, and specific projects throughout California. The Attorney General has commented on at least eight county or regional transportation plan EIRs.<sup>4</sup> While the ultimate legal implications remain unclear, it is obvious that at a minimum the Attorney General will closely scrutinize the environmental analyses for regional transportation plans.

*Senate Bill 1368 (Chapter 598, Statutes of 2006)*

Senate Bill (SB) 1368, signed by Governor Schwarzenegger in September 2006, required the California Public Utilities Commission (PUC) to establish a GHG emissions performance standard for "baseload" generation from investor-owned utilities by February 1, 2007. The California Energy Commission (CEC) was required to establish a similar standard for local publicly-owned utilities by June 30, 2007. The legislation further required that all electricity provided to California, including imported electricity, must be generated from plants that meet or exceed the standards set by the PUC and the CEC. In January 2007, the PUC adopted an interim performance standard for new long-term commitments (1,100 pounds of CO<sub>2</sub> per megawatt-hour), and in May 2007, the CEC approved regulations that match the PUC standard.

*Senate Bill 375 (Chapter 728, Statutes of 2008)*

Senate Bill 375 establishes a process for the CARB to implement the state's global warming legislation (AB 32) for the transportation sector by requiring CARB to adopt by September 30, 2010 regional greenhouse gas (GHG) targets for emissions associated with the automobile and light truck sector. It establishes a Regional Targets Advisory Committee to recommend protocols for setting the targets by September 30, 2009 and requires CARB to release draft targets by June 30, 2010. More specifically, SB 375 requires MPOs such as MTC to develop a Sustainable Communities Strategy (SCS) – a new element of the regional transportation plan (RTP) – to strive to reach the GHG reduction targets.

SB 375 provides assurance that transportation projects programmed for funding prior to 2012 and contained in the 2009 federal transportation improvement program, funded by Prop-

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3 The Attorney General's web portal for global warming may be found at <http://ag.ca.gov/globalwarming/>. The portal contains information on global warming generally, impacts in California, and documentation of the comments, speeches, op-eds, testimony, and litigation actions he has taken to support AB 32 goals.

4 Attorney General EIR comment letters can be found at <http://ag.ca.gov/globalwarming/ceqa/comments.php>

osition 1B, or a voter approved sales tax measure approved prior to 2009 will not be subject to new environmental scrutiny under the bill's provisions.

SB 375 ties the regional housing needs assessment (RHNA) process to the RTP process, requires local governments to rezone their general plans consistent with the updated housing element within three years of adoption, and provides that RHNA allocations must be consistent with the development pattern in the SCS. It moves the RHNA process to an eight-year cycle from the current five-year one. Also, SB 375 provides a California Environmental Quality Act (CEQA) exemption or a streamlined process for housing and mixed-use projects that meet specified criteria, such as proximity to transit.

*Executive Order S-20-06*

Establishes the authority and roles of various departments and leadership roles in implementing AB 32.

*Executive Order S-20-04*

Orders that the state commit to aggressive action to reduce state building electricity usage through multiple measures.

**Local**

The Contra Costa County Greenhouse Gas Emissions Inventory Report, published in August 2007, recommends that the county set a GHG reduction target and discusses actions and potential reduction measures, and identifies potential funding sources for implementation. The Report suggests considering adoption of the Cool Counties Climate Stabilization Declaration, which would call for a reduction in GHG to 80 percent below current levels by 2050. It would also call for a regional plan establishing short-, mid-, and long-term GHG reduction targets.

**Criteria of Significance**

Guidance documents, such as the California Air Pollution Control Officers Association's white paper "CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act" (January 2008), suggest that there are three reasonable approaches to evaluating the significance of the impacts of project related greenhouse gas emissions:

- a "no set threshold" approach, wherein the lead agency determines there are sufficient reasons to not specify a universal threshold for GHG emissions, and instead requires analysis on a project-by-project basis;
- a "zero emissions" threshold, wherein all projects under the lead agency must quantify and mitigate GHG emissions regardless of the size of the project, or prepare EIRs to disclose the unmitigable significant impact; or

- a “non-zero” threshold, wherein the lead agency decides that there are certain GHG emissions sources that are so small they will not contribute substantially to the global GHG problem, and sets thresholds of significance, or a *de minimus* value for cumulative impact.

Using a “zero” threshold approach, the following significance criterion has been applied:

- **Criterion 1:** Implementation of the 2009 CTP would have a potentially significant adverse impact if the projects and actions in it would result in any increase in CO<sub>2</sub>e emissions compared to existing conditions.

### COMPARISON WITH THE NO PROJECT

As stated above, the impact analysis for purposes of determining the significance of impacts will focus on the comparison of the proposed 2009 CTP and existing conditions. However, the projected emissions from the future condition with the 2009 CTP will also be compared with the No Project Alternative. This comparison provides a meaningful perspective on the potential impacts and benefits 2009 CTP.

### Method of Analysis

The 2030 analysis assesses cumulative impacts; it assumes the implementation of the 2009 CTP as well as the development of all forecast land use changes. As a result, the EIR will assess both the changes in VMT due to the 2009 CTP and the additional travel in the regional transportation system generated by planned land uses and projected growth.

The greenhouse gas emission analysis is based on calculations for CO<sub>2</sub> emissions using Emission FACTors (EMFAC) 2007 v2.3 and countywide daily vehicle miles traveled (VMT).<sup>5</sup> EMFAC was developed by the California Air Resources Board and is used to calculate emission rates from all motor vehicles, such as passenger cars to heavy-duty trucks, operating on highways, freeways and local roads in California. EMFAC2007 is the most recent version of this model. EMFAC provides a factor for grams of CO<sub>2</sub> per vehicle mile, which, together with VMT and factors developed to account for additional variables described below, provide estimates for CO<sub>2</sub>e in Contra Costa County from the transportation network. Vehicle activity data was generated from the Countywide Model, as described in *Chapter 2.1: Transportation and Circulation*.

CARB has indicated that it intends to enforce AB 1493, and has advised that these reductions be included in relevant analyses.<sup>6</sup> As such, this analysis parallels the Energy and Air Quality sections of this EIR in depicting the relative influence of state regulations on energy

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<sup>5</sup> [http://www.arb.ca.gov/msei/onroad/latest\\_version.htm](http://www.arb.ca.gov/msei/onroad/latest_version.htm)

<sup>6</sup> This advice was provided in correspondence between CARB and the Metropolitan Transportation Commission, as cited in MTC’s EIR on the Transportation 2035 Plan. The full text of this EIR can be found online at: [http://www.mtc.ca.gov/planning/2035\\_plan/EIR.htm](http://www.mtc.ca.gov/planning/2035_plan/EIR.htm)

use by presenting direct energy calculations for each alternative for three fuel efficiency conditions: with no implementation of the Pavley rules to increase vehicle mileage, with implementation of only the Pavley Phase 1 rules, and with full implementation of both Pavley Phases 1 and 2 (as described in the regulatory setting for AB 1493). The effect of Pavley rules on emissions in Contra Costa County is projected based on regional analysis by the Metropolitan Transportation Commission (MTC) for the Transportation 2035 Plan DEIR. Contra Costa County emissions estimates are multiplied by a factor derived from the emissions differences in the MTC analysis for each Pavley condition. While the impact of Pavley rules on Contra Costa County may vary somewhat from the regional impact, the regional factor provides a useful tool in analyzing the impact of fuel efficiency in the 2009 CTP.

### **CO<sub>2</sub> AND CO<sub>2</sub>E EMISSIONS**

The analysis includes an assessment of the 2030 GHG emissions from the 2030 transportation projects compared to existing conditions and the No Project alternative. The analysis displays both CO<sub>2</sub> and CO<sub>2</sub>e emissions estimates because, while the vast majority of transportation emissions impact is related to CO<sub>2</sub>, discussions of greenhouse gas emissions are frequently in terms of carbon dioxide equivalents. Transportation CO<sub>2</sub>e emissions include a very small contribution from CH<sub>4</sub> and N<sub>2</sub>O emissions, in addition to CO<sub>2</sub>. Other greenhouse gases are not quantified because they are not byproducts of fossil fuel combustion related to the transportation system. EMFAC<sub>2007</sub> does not produce total CO<sub>2</sub>e emissions inventory estimates. To calculate CO<sub>2</sub>e, a ratio of 1.02:1.00 to all EMFAC<sub>2007</sub> generated CO<sub>2</sub> inventory estimates for years 2007 and 2030 to convert them to CO<sub>2</sub>e emissions, a procedure consistent with BAAQMD recommendations for the MTC Transportation 2035 Plan DEIR.

Finally, because Contra Costa County has conducted its own emissions inventory, this EIR attempts to be consistent with the numbers derived in that analysis. See Table 2.13-2 for the County estimate of annual emissions (Contra Costa County, 2008). To that end, the emissions are calibrated to reflect the same transportation emissions (a factor of 1.59). This same factor is applied to all years. This factor potentially accounts for additional sources of transportation emissions not included in the EMFAC modeling (such as indirect transportation emissions), other variations in methodology, variations in VMT, or the included mix of GHG generators. Bus emissions are included in EMFAC and bus VMT has been included in the analysis.

### **SEA LEVEL RISE**

This analysis includes a qualitative assessment of the impact of sea level rise on the proposed 2009 CTP projects. The transportation infrastructure projects are compared with a map of estimated sea level rise for the Bay Area (as provided by BCDC). General observations about where future sea level changes may conflict with proposed new or improved transportation infrastructure investments are made. The implications of potential impact relative to existing conditions are highlighted.

## Summary of Impacts

The impact of the 2009 CTP, considered together with countywide growth and application of Pavley Phase 1 and Phase 2 rules, would result in lower rates of carbon dioxide emissions than existing conditions, but would nonetheless contribute to the cumulative green house gases in the atmosphere. In addition, implementation of the 2009 CTP projects would have the potential to result in a significant cumulative increase in exposure to risk related to sea level rise. While both of these impacts are significant cumulative impacts, the 2009 CTP is not found to have a cumulatively considerable contribution. However, given the importance of global climate change, several mitigation measures are proposed to further reduce impacts related to global warming and greenhouse gases.

## Impacts and Mitigation Measures

### CUMULATIVE IMPACT

#### **2.12-1 Implementation of the 2009 CTP, combined with forecast countywide growth, would contribute to GHG emissions. (*Significant Cumulative Impact, Project Contribution Not Cumulatively Considerable*)**

Global climate change can be considered a significant cumulative impact due to the cumulative nature greenhouse gas emissions from human activities across the globe and over many decades. As global climate change is accelerated by greenhouse gases, any additional greenhouse gas emissions beyond what exists today in the atmosphere can be considered to contribute somewhat to this significant cumulative impact. For the purposes of this EIR, this analysis makes a determination about whether the proposed Project makes a cumulatively considerable contribution to this significant cumulative impact.

As shown in Table 2.12-3, implementation of the 2009 CTP, when considered with Pavley Phase 1 and Phase 2 rules enforced, results in 1.9 percent fewer CO<sub>2</sub> equivalent emissions per day than existing conditions. In addition, the 2009 CTP, when compared to the No Project, results in a decrease in CO<sub>2</sub> equivalent emissions for all cases (No Pavley, Pavley 1, and Pavley 1 and 2). The fact that, in the No Pavley case, emissions from the 2009 CTP are higher than the existing condition reflects the cumulative impact of population growth and the related increase in transportation use. It also reflects the balance between improving technology and standards for emissions and acknowledging that absolute numbers of trips and VMT may increase as population size and employment levels increase.

In addition, these model results do not reflect additional steps, such as growth management planning, that are being taken by the Agency. These steps, along with appropriate project level design beyond the scope of a program level EIR, could further lead to lower emissions levels throughout the county. The Authority recognizes that a multi-faceted and integrated approach will be essential for maximum mitigation of climate change.

As explained in more detail in *Chapter 3.2: CEQA Required Conclusions: Growth Inducing*, the transportation system itself is not inducing growth, but rather that growth is a result of

overall regional demographic and employment changes that are unrelated to the transportation investments proposed in the 2009 CTP. The fact that emissions under the proposed Project are lower than under the No Project future scenario suggests that, all other things being equal, the contribution of the proposed Project to the significant cumulative impact of global climate change is a reduction, and therefore not cumulatively considerable. This conclusion is consistent with that of the growth-inducing impact assessment in Chapter 3.2.

#### **Interim Years**

As described in *Chapter 2.1: Transportation and Circulation*, overall VMT is expected to increase between now and the year 2030. As shown in Table 2.13.3, it is primarily the new state regulations on fuel efficiency that are expected to reduce vehicle emissions. Regional carbon dioxide emissions from motor vehicles are estimated to increase and peak around year 2010 because the region will already be experiencing increases in VMT even though Pavley Phase 1 will not yet be fully implemented (it only applies to 2009 and later model year vehicles). After 2010, regional CO<sub>2</sub> emissions are expected to decline as the Pavley Phase 1 rules are implemented, and will continue to decline in later years as Pavley Phase 2 rules are implemented.

While this EIR overall evaluates the long term impact of the 2009 CTP with an analysis horizon of 2030, and does not generally evaluate interim impacts, it should be noted that in the case of global climate change there is a need to make interim efforts at reduction of emissions. Additional measures are needed to demonstrate ongoing efforts to comply with AB 32, particularly given the cumulative nature of greenhouse gases, which persist in the atmosphere.

So, despite lower emissions in the long term for the Project, in the near term GHG emissions will increase compared to existing condition. As a consequence, the Authority will implement the mitigation measures listed below.

**Table 2.12-3: Existing and Future CO<sub>2</sub> and CO<sub>2</sub>e Emissions Comparison (emissions in metric tons)**

	<i>Total Daily VMT, Including Bus VMT</i>	<i>Regional Pavley Factor</i>	<i>Daily CO<sub>2</sub> Emissions</i>	<i>% Change from Existing Conditions</i>	<i>Daily CO<sub>2</sub>e Emissions</i>	<i>% Change from Existing Conditions</i>
<i>Existing Conditions</i>	20,335,750	-	12,200	-	12,444	-
No Project						
<i>No Pavley</i>	29,774,817	1.00	18,609	52.5%	18,982	52.5%
<i>Pavley I</i>	29,774,817	0.74	13,733	12.6%	14,008	12.6%
<i>Pavley I and II</i>	29,774,817	0.66	12,364	1.3%	12,612	1.3%
Project						
<i>No Pavley</i>	29,948,525	1.00	17,991	47.5%	18,351	47.5%
<i>Pavley I</i>	29,948,525	0.74	13,288	8.9%	13,554	8.9%
<i>Pavley I and II</i>	29,948,525	0.67	11,968	-1.9%	12,208	-1.9%

Source: Dyett and Bhatia, 2008.

## MITIGATION MEASURES

Because of the urgent need to respond to the challenges of global warming, and because CCTA recognizes that future emissions rates might go up without successful implementation of state-wide policy to increase fuel efficiency, the following additional measures will be implemented to reduce GHG emissions related to the proposed Plan, particularly in the short term:

### Mitigation Measure 2.12-1

Where projects could contribute to GHG emissions, sponsors shall consider measures to minimize or eliminate impacts as part of the design of the project and its environmental review under CEQA and NEPA. Potential mitigation measures could be drawn from or be consistent with the Global Warming Measures published by the Attorney General's Office, the Bay Area Regional Agency Climate Protection Program – Consolidated Recommendations, other guidance from State and federal agencies or similar policy guidance. Typical mitigation measures include:

- Adopt and implement “green building” practices for any public buildings funded by CCTA to achieve a LEED™ Silver or better or equivalent certification;
- Adopt “green construction” policies and practices for all CCTA- funded projects, These should include but not be limited to requirements for use of the lowest emitting construction equipment and fuels (e.g. diesel-powered vehicles with EPA Tier 3 or better engines or retrofitting to meet equivalent emission standards as Tier 3 engines);
- Require use of light colored pavement for solar reflectivity and reduced heat island effects wherever construction costs are no higher than 5 or 10 percent of the least cost alternative paving material;
- Require installation of solar photovoltaic systems or use of renewable sources of energy for transportation buildings and maintenance facilities, wherever “feasible”, as the term is defined in CEQA;
- Require shade tree planting as part of specified types of construction projects or wherever CCTA-funded construction results in loss of tree cover because trees have " carbon sequestration capacity;
- Establish or update minimum standards for construction management for CCTA-funded transportation projects, including specifying minimum content for recycled products in aggregate, concrete, etc. and construction waste management;<sup>7</sup>

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<sup>7</sup> In a May 2007 letter, for example, the AG mentioned the value of “warm mix” asphalt to reduce GHG emissions as a feasible alternative paving material, Alameda County also has noted the value of requiring use of fly ash in concrete in its Green Building guidance materials.

- Establish standards or incentives for light pollution reduction related to street lighting and lighting of transportation and parking facilities funded by CCTA to promote low-energy use for permanent as well as temporary fixtures.

#### **SIGNIFICANCE AFTER MITIGATION**

With implementation of mitigation measures 2.12a and 2.12b, this impact would be reduced, and the Project's contribution to the overall significant cumulative impact would not be cumulatively considerable.

#### **CUMULATIVE IMPACT**

**2.12-2 Implementation of the 2009 CTP projects would have the potential to result in a significant cumulative increase in exposure to a risk related to sea level rise. (*Significant Cumulative Impact, Project Contribution Not Cumulatively Considerable*)**

Sea level rise is a global repercussion of climate change, making the direct influence of local greenhouse gas emissions on sea level rise in Contra Costa County impossible to determine with any certainty. Nonetheless, sea level rise is likely to have widespread effects on coastal and Bay margin buildings, infrastructure, beaches, wetlands, agricultural lands, and water supply. To the extent that proposed new transportation infrastructure projects or proposed increases in capacity of existing systems create additional vulnerability to sea level rise and storm surge, the proposed Project would be found to contribute to this overall regionally significant cumulative impact.

To determine the relative contribution of the proposed Project to this cumulative impact, major projects in the 2009 CTP were visually compared with a map of areas vulnerable to a 16-inch sea level rise, based on estimates by the San Francisco Bay Conservation and Development Commission (BCDC) for the years 2040 to 2060. While the timeline for BCDC's estimates exceeds the timeline for this EIR, the proposed transportation infrastructure is also expected to endure beyond the horizon of this EIR, making the comparison reasonable. Areas that would be impacted by sea level rise include areas along the north shore of the county bordering Suisun Bay, near Martinez and San Pablo along the bay, and areas near North Richmond along the San Rafael Bay.

Up to four larger projects in the 2009 CTP may be affected by the sea level rise, including the I-680/ Marina Vista Interchange, the Richmond Parkway upgrade, landside improvements for the Martinez Ferry, and phase III improvements for the Martinez intermodal project. Additional small scale arterial, bicycle and pedestrian projects may be impacted. In addition, existing infrastructure, for instance the existing Amtrak right of way where it runs along Suisun Bay through Suisun Marsh, would likely be impacted by sea level rise. The potential contribution of new risk associated with these projects is minimal when compared to the cumulative vulnerability associated with existing transportation infrastructure throughout the Bay Area.

**MITIGATION MEASURES**

Extensive planning is necessary to determine the appropriate form of shoreline protection over both the short- and long-term. It may be necessary to protect certain locations with hard engineering elements such as sea walls in the short-term, while softer solutions such as wetlands restoration are appropriate from a long-term perspective. Short-term solutions sometimes lead to additional impacts on the Bay ecosystem and shoreline environments. Furthermore, virtually all new protective infrastructure required as mitigation against the risk of sea level rise will also incrementally contribute to additional greenhouse gas emissions and climate change through construction-related emissions. Thus, agencies should seek out long-term solutions and mitigation options as early in the process as possible to avoid these secondary impacts.

**Mitigation Measure 2.12-2**

Where projects could have the potential to result in a significant cumulative increase in exposure to a risk related to sea level rise, sponsors shall consider measures to minimize or eliminate impacts as part of the design of the project and its environmental review under CEQA and NEPA. Potential mitigation measures could be drawn from or be consistent with the Global Warming Measures published by the Attorney General's Office, the Bay Area Regional Agency Climate Protection Program – Consolidated Recommendations, other guidance from State and federal agencies or similar policy guidance. Typical mitigation measures include:

- To determine the likely impacts of sea level rise on transportation infrastructure and to identify the appropriate adaptation strategies to reduce or avoid these impacts, conduct a vulnerability assessment for the transportation infrastructure projects and identify the appropriate adaptation strategies to protect those transportation resources that are likely to be affected and are a priority to protect;
- Consider sea level rise and potential increases in storm surge inundation in engineering designs, and incorporate mitigation measures where applicable. These mitigation measures should consider the effects on Bay resources and avoid or reduce future risk to the infrastructure and adjoining areas; and
- For those transportation projects that do not involve new infrastructure but rather invest in increasing capacity of existing infrastructure, demonstrate that they have investigated the vulnerability of their existing facilities to sea level rise and storm surge inundation and are budgeting for mitigation measures to adapt to projected sea level rise and storm surge. These mitigation measures should consider the effects on Bay resources and avoid or reduce future risk to the infrastructure and the region.

**SIGNIFICANCE AFTER MITIGATION**

Implementation of these mitigation measures is expected to help ensure that the proposed Project's contribution to the overall significant cumulative sea level rise impact is not cumulatively considerable.