## 4.13 GREENHOUSE GAS EMISSIONS AND GLOBAL CLIMATE CHANGE

## 4.13.1 INTRODUCTION

In California, observational trends from the last half century show warmer winter and spring temperatures, decreased spring snow levels in lower- and mid-elevation mountains, up to one month earlier snowpack melting, and flowers blooming one- to two-weeks earlier than under historical conditions (Cayan et al. 2006b). Research suggests that human activities, such as the burning of fossil fuels and clearing of forests, contribute additional carbon dioxide (CO<sub>2</sub>) and other heat trapping gas emissions into the atmosphere. Future global climate change could have widespread consequences that would affect many of California's important resources, including its water supply.

This section considers the impacts of the Placer Vineyards Specific Plan ("the Project"), including comparisons of the Placer Vineyards Base Specific Plan ("Base Plan") version of the Project and the Placer Vineyards Blue Print Specific Plan Alternative ("Blueprint Alternative"), on greenhouse gas emissions and global climate change (section 4.13.3). This section also considers the impacts of global climate change on the reliability of the Project's anticipated water supply (section 4.13.4).

## 4.13.2 ENVIRONMENTAL SETTING

## EXISTING AIR QUALITY – GREENHOUSE GASES AND LINKS TO GLOBAL CLIMATE CHANGE

Various gases in the Earth's atmosphere, classified as atmospheric greenhouse gases (GHGs), play a critical role in determining the Earth's surface temperature. Solar radiation enters Earth's atmosphere from space, and a portion of the radiation is absorbed by the Earth's surface. The Earth emits this radiation back toward space, but the properties of the radiation change from high-frequency solar radiation to lower-frequency infrared radiation. Greenhouse gases, which are transparent to solar radiation, are effective in absorbing infrared radiation. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This phenomenon is known as the greenhouse effect.

Among the prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), ozone (O<sub>3</sub>), water vapor, nitrous oxide (N<sub>2</sub>O), and chlorofluorocarbons (CFCs). Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for enhancing the greenhouse effect (Ahrens 2003). Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors (California Energy Commission 2006a). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (California Energy Commission 2006a). A byproduct of fossil fuel combustion is CO<sub>2</sub>. Methane, a highly potent GHG, results from offgassing associated with agricultural practices and landfills. Processes that absorb and accumulate CO<sub>2</sub>, often called CO<sub>2</sub> "sinks," include uptake by vegetation and dissolution into the ocean.

As the name implies, global climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern, respectively. California is the 12th to 16th largest emitter of CO<sub>2</sub> in the world and produced 492 million gross metric tons of carbon dioxide equivalents in 2004 (California Energy Commission 2006a). Carbon dioxide equivalents is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse effect. This potential, known as the global warming potential of a GHG, is also dependent on the lifetime, or persistence, of the gas molecule in the atmosphere. For example, CH<sub>4</sub> is a much more potent GHG than CO<sub>2</sub> As described in Appendix C, "Calculation Referenced," of the General Reporting Protocol of the California Climate Action Registry (2006), one ton of CH<sub>4</sub> has the same contribution to the greenhouse effect as approximately 21 tons of CO<sub>2</sub>. Expressing GHG emissions in carbon dioxide equivalents takes the contribution of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO<sub>2</sub> were being emitted. Consumption of fossil fuels in the transportation sector was the single largest source of California's GHG emissions in 2004, accounting for 40.7% of total GHG emissions in the state (California Energy Commission 2006a). This category was followed by the electric power sector (including both in-state and outof-state sources) (22.2%) and the industrial sector (20.5%) (California Energy Commission 2006a).

## FEEDBACK MECHANISMS AND UNCERTAINTY

Many complex mechanisms interact within Earth's energy budget to establish the global average temperature. For example, a change in ocean temperature would be expected to lead to changes in the circulation of ocean currents, which, in turn would further alter ocean temperatures. There is uncertainty about how some factors could affect global climate change because they have the potential to both enhance and neutralize future climate warming. Examples of these conditions are also described below.

#### **Direct and Indirect Effects of Aerosols**

Aerosols, including particulate matter, reflect sunlight back to space. As particulate matter attainment designations are met, and fewer emissions of particulate matter occur, the cooling effect of anthropogenic aerosols would be reduced, and the greenhouse effect would be further enhanced. Similarly, aerosols act as cloud condensation nuclei, aiding in cloud formation and increasing cloud lifetime. Clouds can efficiently reflect solar radiation back to space (see discussion of the cloud effect below). As particulate matter emissions are reduced, the indirect positive effect of aerosols on clouds would be reduced, potentially further amplifying the greenhouse effect.

## The Cloud Effect

As global temperature rises, the ability of the air to hold moisture increases, facilitating cloud formation. If an increase in cloud cover occurs at low or middle altitudes, resulting in clouds with greater liquid water content such as stratus or cumulus clouds, more radiation would be

reflected back to space, resulting in a negative feedback mechanism, wherein the side effect of more cloud cover resulting from global warming acts to balance further warming. If clouds form at higher altitudes in the form of cirrus clouds, however, these clouds actually allow more solar radiation to pass through than they reflect, and ultimately they act as a GHG themselves. This results in a positive feedback mechanism in which the side effect of global warming acts to enhance the warming process. This feedback mechanism, known as the "cloud effect" contributes to uncertainties associated with projecting future global climate conditions.

#### Other Feedback Mechanisms

As global temperature continues to rise, CH<sub>4</sub> gas currently trapped in permafrost, would be released into the atmosphere when areas of permafrost thaw. Thawing of permafrost attributable to global warming would be expected to accelerate and enhance global warming trends. Additionally, as the surface area of polar and sea ice continues to diminish, the Earth's albedo, or reflectivity, is also anticipated to decrease. More incoming solar radiation will likely be absorbed by the Earth rather than being reflected back to space, further enhancing the greenhouse effect. The scientific community is still studying these and other positive and negative feedback mechanisms to better understand their potential effects on global climate change.

## **REGULATORY FRAMEWORK**

This section describes recent state regulations that specifically address greenhouse gas emissions and global climate change. At the time of writing, there are no regulations setting ambient air quality emissions standards for greenhouse gases.

#### **ASSEMBLY BILL 1493**

In 2002, then-Governor Gray Davis signed Assembly Bill (AB) 1493. AB 1493 requires that the California Air Resources Board (ARB) develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty truck and other vehicles determined by the ARB to be vehicles whose primary use is noncommercial personal transportation in the state."

#### **EXECUTIVE ORDER S-3-05**

Executive Order S-3-05, which was signed by Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total greenhouse gas emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80% below the 1990 level by 2050.

The Executive Order directed the Secretary of the California Environmental Protection Agency (CalEPA) to coordinate a multi-agency effort to reduce greenhouse gas emissions to the target levels. The Secretary will also submit biannual reports to the governor and state legislature

describing: (1) progress made toward reaching the emission targets; (2) impacts of global warming on California's resources; and (3) mitigation and adaptation plans to combat these impacts. To comply with the Executive Order, the Secretary of the CalEPA created a Climate Act Team (CAT) made up of members from various state agencies and commission. CAT released its first report in March 2006. The report proposed to achieve the targets by building on voluntary actions of California businesses, local government and community actions, as well as through state incentive and regulatory programs.

## ASSEMBLY BILL 32, THE CALIFORNIA CLIMATE SOLUTIONS ACT OF 2006

In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Climate Solutions Act of 2006. AB 32 requires that statewide GHG emissions be reduced to 1990 levels by the year 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that will be phased in starting in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources. AB 32 specifies that regulations adopted in response to AB 1493 should be used to address GHG emissions from vehicles. However, AB 32 also includes language stating that if the AB 1493 regulations cannot be implemented, then ARB should develop new regulations to control vehicle GHG emissions under the authorization of AB 32.

AB 32 requires that ARB adopt a quantified cap on GHG emissions representing 1990 emissions levels and disclose how it arrives at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms to ensure that the state achieves reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.

#### **SENATE BILL 1368**

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 greenhouse gas emission performance standard for baseload generation from investor owned utilities by February 1, 2007. The California Energy Commission (CEC) must establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the greenhouse gas 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 and CEC.

# PROPOSED GOALS AND POLICIES POTENTIALLY AFFECTING GHG EMISSIONS OF THE PLACER VINEYARDS PROJECT

The proposed Specific Plan contains the following goals and policies that will tend to reduce GHG emissions in the Specific Plan area:

- Goal 3.12 Help to achieve a balance of jobs and housing within the region that minimizes environmental impacts by reducing vehicle miles traveled by commuters and air pollution released from automobiles.
- Goal 3.15 Provide schools that are within a safe, convenient walking distance of residential neighborhoods, as an element of the open space fabric in the community.
- Goal 4.12 Encourage efficient energy use and conservation.
- Goal 4.13 Minimize air quality impacts on the Placer Vineyards area and the region.
- Policy 4.36 All residential units will be developed in compliance with State of California Title 24 energy conservation measures.
- Policy 4.37 Use of passive and active solar devices such as solar collectors, solar cells, and solar heating systems, integrated into the building designs, are encouraged.
- Policy 4.37 Building and site design should take into account the solar orientation of buildings during design and construction.
- Policy 4.39 Local area source emissions shall be minimized through a variety of strategies:
  - 1. Promote low-emission energy use by requiring building design features that accommodate and encourage use of alternative energy sources.
  - 2. Promote low-emission energy use by incorporating landscaping conducive to passive solar energy uses including:
    - a. Buildings are encouraged to be oriented in a south-to-southwest direction, where feasible.
    - b. Deciduous trees are encouraged to be planted on the west and south sides of structures.
    - c. Provide landscapes with drought-resistant species and groundcovers rather than pavement to reduce heat reflection.
    - d. Require minimum parking lot shading at all commercial and office development.
- Policy 4.41 Construction activities will comply with all requirements of grading permits and PCAPCD.
- Policy 4.42 PCAPCD may replace or supplement air pollution control measures for individual projects as new technology and feasible measures become available over the course of the Plan buildout.

- Goal 5.1 Create and maintain a balanced, multi-modal transportation system that provides for the efficient and safe movement of people, goods, and services.
- Goal 5.5 Minimize traffic congestion in Placer Vineyards by discouraging regional thrutraffic on collector and local residential streets.
- Goal 5.6 Promote public transit systems as an alternative means of transportation to reduce traffic congestion.
- Goal 5.7 Provide a system of on- and off-street trails that connect to destinations within the Plan Area and to the regional trail network.
- Policy 5.16 Bus Rapid Transit System. A public transit system and dedication of the right-of-way corridor for future bus rapid transit with feeder bus network shall be provided along Watt Avenue from Baseline Road to the Dyer Lane intersection just north of Dry Creek.
- Policy 5.17 Streetcar Right-of-Way. Dedication of rights-of-way for a future streetcar system shall be provided along the north side of Town Center Drive, extending from the transit center on Watt Avenue to the Town Center, ending at 16th Street.
- Policy 5.18 Multi-modal Transit Center. A transit center will be located on Town Center Drive to serve as a transfer point for regional and local transit services. The transit center site shall be of sufficient size to accommodate all future anticipated uses. It will include covered shelters, bus staging areas, park-and-ride lots, and bicycle storage facilities.
- Policy 5.19 Transit Service and Facilities. Placer Vineyards shall participate in regional service with connection to light rail transit on Watt Avenue in Sacramento County, Regional University, Galleria Mall, and other regional centers. As each parcel is developed, provisions for bus stops, turnouts, shelters, park-and-ride lots, bike lockers, lighting, and other transit support facilities will be examined and constructed.
- Policy 5.20 Provision of Park-and-Ride Lots. Park-and-ride lots shall be established and maintained at the Town Center and transit center at the East Village Center. The majority of the park-and-ride spaces shall be accommodated in the transit center where a majority of local and regional commute trips will be concentrated. A minimum of 50 spaces shall be provided in the Town Center, established as shared parking. Other smaller park-and-ride lots are encouraged to be established as a shared parking use incorporated into the overall parking design of other commercial and office centers or adjacent to public transit.

In total, a minimum of 193 parking spaces shall be distributed between the parkand-ride lots. More park-and-ride lots should be provided, especially adjacent to

- neighborhood activity centers, transit routes, and major transit corridors to encourage ridesharing, promote use of public transit, and reduce air pollution.
- Policy 5.21 Trail System. Trails shall be provided as identified by Figure 5.6, "Off-Street Trails Diagram."
- Policy 5.22 Types of Trails. Trails shall be provided within the Plan Area that offer a variety of experiences, including trails within and between parks and other public open space lands or to schools, and trails that connect to regional trails and transit facilities within and outside of the Plan Area.
- Policy 5.23 Provision of Trails. Private developers shall incorporate trail routes that are within their proposed tentative maps as identified in the trails diagram (see Figure 5.6). Placer Vineyards trails shall conform to the following standards.
  - 1. In the Dry Creek corridor only, Class I bicycle trails shall be 12-foot-wide, asphalt concrete paving with 2-foot-wide decomposed granite trails on both sides of the asphalt concrete paving.
  - 4. Informational signs will be placed throughout the trail system (e.g., "2.4 miles to Town Center").
  - 7. Collapsible bollards will be placed at entries to restrict vehicular access where trails and streets intersect.
  - 9. Traffic calming methods and signage shall be used to enhance the safety of the trail systems where they cross major or collector streets.
  - 10. A Class I trail crossing shall be provided under the Watt Avenue bridge within the Dry Creek corridor.
  - 11. A Class I trail shall also be provided on the east side of the Dry Creek bridge and along Watt Avenue, extending to the Placer/Sacramento County line. The Class I trail on the east side of the bridge will be separated from traffic by a concrete railing.
- Policy 5.24 Construction of Bike Trail Improvements. Bike trail improvements are planned to connect Morgan Creek to Gibson Ranch Park. Landowners shall design and construct bike trail improvements within the open space portions of their property according to the following standards and provisions of the Development Agreement.
  - 1. In conjunction with the construction of a core backbone roadway system, a set of core backbone trails adjacent to these roadways, as described in Section 9.3 and the Public Facilities Financing Plan, shall be constructed at the same time that the core backbone roadways are constructed.

- 2. Landowners shall install sections of the trail when it installs subdivision improvements within the parcels adjacent to the open space. Trail connections to the core backbone trails shall be included as part of the subdivision improvements.
- 3. Bike trail sections shall be constructed and improved according to Figure 5.6, "Off-Street Trails Diagram." Bike trails shall be designed in accordance with the County's design standards for off-street bike trails and the guidelines provided in the Specific Plan.
- 4. Landowners shall proceed to complete the construction of bike trail improvements at the same time that they install and complete the balance of the subdivision improvements for the parcel(s) adjacent to the open space.
- 5. Landowners shall be responsible for all costs associated with the design and construction of bike trail improvements, including the costs of preparing required plans and drawings and obtaining all required permits.
- 6. Upon completion of bike trail improvements by the landowner, the County shall accept the dedication of the bike trail and applicable open space area and assume ownership and maintenance of these facilities, provided that the cost of maintenance shall be funded by the County Service Area.
- Policy 6.24 Pedestrian Orientation. Design elements that accommodate pedestrians and cyclists shall be equally treated or take precedence over elements that primarily accommodate automobiles, especially in the Town Center, Village Centers, Neighborhood Centers and access areas leading into parks, schools and other public facilities. Retail centers and commercial areas shall be designed to provide maximum pedestrian accessibility, as described below.
  - 1. Ground-floor commercial buildings shall be oriented to plazas, parks, and pedestrian-oriented spaces and streets rather than to interior blocks or parking lots.
  - 2. Street-level windows and numerous building entries, including arcades, porches, bays, and balconies, are encouraged.
  - 3. Walls of commercial establishments without an entry or a pedestrian route shall include windows and display areas, or shall be lined with retail shops to provide visual interest to pedestrians.
  - 4. Entries to small shops and offices shall be sited to directly open onto a pedestrian-oriented street. Buildings with multiple retail tenants should have numerous street entries.

- 5. Parking areas shall be designed with separate vehicular and pedestrian circulation paths and include traffic claming design features. Alternative surface materials are encouraged to differentiate pedestrian circulation paths.
- 6. Off-street parking should be located at the rear of buildings with separated walkways leading to the street and entryways.
- 7. Build-to-lines and minimum height limits should be incorporated in the design of the Town Center.
- Policy 6.25 New parking lots serving retail and office developments shall include tree plantings designed to result in 50% shading of parking lot surface areas within 15 years. These shading requirements shall apply to all impervious surfaces on which a vehicle can drive including parking stalls, drives, and maneuvering areas within the property. Placer County shall use the City of Sacramento Parking Lot Tree Shading Design and Maintenance Guidelines, June 17, 2003 edition to implement these requirements.
- Policy 6.32 Transit Access. Village centers shall be transit-oriented activity nodes. Bus turnouts, shelters, and clear pedestrian paths from the street to the commercial centers, transit centers, parks, and other public facilities should be incorporated into the design of the village centers.
- Policy 6.37 Pedestrian Access. Neighborhood commercial centers shall be designed to encourage pedestrian access along the face of commercial buildings and along public sidewalks.
  - 1. Covered walkways and awnings should be provided along the fronts of major anchor stores and connect with other multi-tenant retail shops.
  - 2. Bicycle and pedestrian trails should be provided to allow convenient access between neighborhood commercial centers and surrounding residential neighborhoods.
- Policy 6.39 Transit Access. Bus turnouts, shelters, and clear pedestrian paths from the street to the major commercial tenants should be incorporated into the design of neighborhood centers.
- Goal 6.26 Develop residential areas as open and linked neighborhoods that encourage alternative modes of transportation walking, biking, and transit use with a school or neighborhood park located within easy walking distance of the surrounding community as the focal point.
- Goal 8.3 Conserve energy and water through the use of recycled water and other designs.

## Roadway Design Guidelines

Roadways shall be designed according to the following guidelines:

- 1. Roads shall be designed for their dual roles as vehicular and non-vehicular transportation corridors with landscape berms or open space parkways, containing bicycle and pedestrian trails.
- 4. A finer grain network of connector streets shall be located to provide convenient access to all land use parcels.
- 5. Multiple points of access to development areas are encouraged, to maximize the number of streets that carry traffic and the distribution of traffic loads from each development area.
- 7. Neighborhoods should be designed with internal connecting streets to encourage a more open and accessible network for residents and improve the distribution of traffic throughout the roadway network. However, cul-de-sac roads are not excluded within residential areas as long as they are not excessively used.

## 4.13.3 IMPACTS AND MITIGATION MEASURES

## SIGNIFICANCE CRITERIA

No air district in California, including the Placer County Air Pollution District, has identified a significance threshold for GHG emissions or a methodology for analyzing air quality impacts related to greenhouse gas emissions. The state has identified 1990 emission levels as a goal through adoption of AB 32. To meet this goal, California would need to generate lower levels of GHG emissions than current levels. However, no standards have yet been adopted quantifying 1990 emission targets. It is recognized that for most projects there is no simple metric available to determine if a single project would help or hinder meeting the AB 32 emission goals. In addition, at this time AB 32 only applies to stationary source emissions. Consumption of fossil fuels in the transportation sector accounted for over 40% of the total GHG emissions in California in 2004. Current standards for reducing vehicle emissions considered under AB 1493 call for "the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles," and do not provide a quantified target for GHG emissions reductions for vehicles.

Emitting CO<sub>2</sub> into the atmosphere is not itself an adverse environmental affect. It is the increased concentration of CO<sub>2</sub> in the atmosphere resulting in global climate change and the associated consequences of climate change that results in adverse environmental affects (e.g., sea level rise, loss of snowpack, severe weather events). Although it is possible to generally estimate a project's incremental contribution of CO<sub>2</sub> into the atmosphere, it is typically not possible to determine whether or how an individual project's relatively small incremental contribution might

translate into physical effects on the environment. Given the complex interactions between various global and regional-scale physical, chemical, atmospheric, terrestrial, and aquatic systems that result in the physical expressions of global climate change, it is impossible to discern whether the presence or absence of CO<sub>2</sub> emitted by the project would result in any altered conditions.

Given the challenges associated with determining a project specific significance criteria for GHG emissions when the issue must be viewed on a global scale, a quantitative significance criteria is not proposed for the Placer Vineyards project. For this analysis, a project's incremental contribution to global climate change would be considered significant if due to the size or nature of the project it would generate a substantial increase in GHG emissions relative to existing conditions.

## ESTIMATED EMISSIONS OF GREENHOUSE GASES FROM THE PLACER VINEYARDS PROJECT

GHG emissions associated with the Placer Vineyards project were estimated using CO<sub>2</sub> emissions as a proxy for all GHG emissions. This is consistent with the current reporting protocol of the California Climate Action Registry (CCAR). Calculations of GHG emissions typically focus on CO<sub>2</sub> because it is the most commonly produced GHG in terms of both number of sources and volume generated, and because it is among the easiest GHGs to measure. However, it is important to note that other GHGs have a higher global warming potential than CO<sub>2</sub>. For example, as stated previously, 1 lb of methane has an equivalent global warming potential of 21 lb of CO<sub>2</sub> (California Climate Action Registry 2006). Nonetheless, emissions of other GHGs from the Placer Vineyards project (and from almost all GHG emissions sources) would be low relative to emissions of CO<sub>2</sub> and would not contribute significantly to the overall generation of GHGs from the project.

Although the CCAR provides a methodology for calculating GHG emissions, the process is designed to be applied to a single or limited number of entities or operations where detailed information on emissions sources is available (e.g., usage of electricity and natural gas, numbers and types of vehicles and equipment in a fleet, type and usage of heating and cooling systems, emissions from manufacturing processes). Information at this level of detail is not available for the Placer Vineyards project. For example, the ultimate GHG emissions from the approximately 98 acres of Business Park land use could vary substantially depending on the type and amount of office and commercial uses that are developed, the density of employees in each facility, the hours of operation for each facility, and other factors. Similarly, GHG emissions from the approximately 13,400 residences could vary substantially based on numerous factors, such as the sizes of homes, the type and extent of energy efficiency measures that might be incorporated into each home's design, the type and size of appliances installed in the home, and whether solar energy facilities are included on any of the residences. Given the lack of detailed design and operational information available at this time for facilities in the Placer Vineyards area, the CCAR emissions inventory methodology is not appropriate for estimating GHG emissions from the project.

The traffic analysis conducted for the project in support of the revised draft environmental impact report (RDEIR) and the recirculated revised draft environmental impact report

(Recirculated RDEIR) provide data that can be used to estimate CO<sub>2</sub> emissions from project-generated vehicle trips. Buildout of the project would result in 195,246 vehicle trips per day (see Table 4.7-14 in the draft Recirculated RDEIR). Assuming a trip rate of 7.43 miles per trip as described in Appendix J of the RDEIR, the Placer Vineyards project at full buildout would generate an average of 1,450,678 vehicle miles traveled (VMT) per day, or approximately 529 million VMT annually. Assuming an emissions factor for future CO<sub>2</sub> emissions from vehicles of approximately 366 grams of CO<sub>2</sub> per mile (California Air Resources Board 2002), approximately 213,000 tons of CO<sub>2</sub> per year would be generated by project-generated vehicle trips. Note that although this future CO<sub>2</sub> emissions factor does assume certain reductions in vehicle emissions due to future vehicle models operating more efficiently, it does not take into account additional vehicle emission reductions that might take place in response to AB 1493, if mobile source emission reductions are ultimately implemented through this legislation.

It is also important to note that this CO<sub>2</sub> emission estimate for vehicle trips associated with the Placer Vineyards project is likely much greater than the emissions that will actually occur. The analysis methodology used for the emissions estimate assumes that all emissions sources (in this case vehicles) are new sources and that emissions from these sources are 100% additive to existing conditions. This is a standard approach taken for air quality analyses. In many cases, such an assumption is appropriate because it is impossible to determine whether emissions sources associated with a project move from outside the air basin and are in effect new emissions sources, or whether they are sources that were already in the air basin and just shifted to a new location. However, because the effects of GHGs are global, a project that merely shifts the location of a GHG-emitting activity (e.g., where people live, where vehicles drive, or where companies conduct business) would result in no net change in global GHG emissions levels. For example, if a substantial portion of California's population migrated from the South Coast Air Basin (managed by the South Coast Air Quality Management District) to the San Joaquin Valley Air Basin (managed by the San Joaquin Valley Air Pollution Control District), this would likely result in decreased emissions in the South Coast Air Basin and increased emissions in the San Joaquin Valley Air Basin, but little change in overall global GHG emissions. However, if a person moves from one location where the land use pattern requires substantial vehicle use for day-to-day activities (commuting, shopping, etc.) to a new development that promotes shorter and fewer vehicle trips, more walking, and overall less energy usage, then it could be argued that the new development would result in a potential net reduction in global GHG emissions.

It is impossible to know at this time whether residents in the Placer Vineyards project area will have longer or shorter commutes relative to their existing homes; whether they will walk, bike, and use public transportation more or less than under existing circumstances; and whether their overall driving habits will result in higher or lower VMT. Much of the vehicle generated CO<sub>2</sub> emissions attributed to the project could simply be from vehicles currently emitting CO<sub>2</sub> at an existing location moving to the project site, and not from new vehicle emissions sources relative to global climate change. Therefore, although it is not possible to calculate the net contribution of vehicle generated CO<sub>2</sub> emissions from the Placer Vineyards project (i.e., project generated emissions minus current emissions from vehicles that would move to the project site), the net CO<sub>2</sub> contribution would likely be much less than the 210,000 tons of CO<sub>2</sub> per year calculated above.

Although the estimate of 213,000 tons of CO<sub>2</sub> emitted per year from project related vehicle trips is higher than would actually occur, it provides a starting point for further emissions calculations. As identified above in the "Environmental Setting" discussion (section 4.13.2), fossil fuel consumption in the transportation sector was the single largest source of California's GHG emissions in 2004, accounting for 40.7% of total GHG emissions in the state (California Energy Commission 2006a). Making the general assumption that the proportion of transportation-sector emissions from the Placer Vineyards project at buildout would be similar to the statewide results for 2004, overall CO<sub>2</sub> emissions from the Placer Vineyards project would be approximately 523,000 tons per year.

This should be considered a very general estimate providing an indication of the order of magnitude of CO<sub>2</sub> emissions from the Placer Vineyards project. As discussed above, numerous factors that can substantially affect the project's CO<sub>2</sub> emissions (structural designs, type of building occupants, hours of operation) will not be known until buildout is complete. In addition, the discussion above identifying that net/actual CO<sub>2</sub> emissions from project generated vehicle trips would be much less than calculated also applies to all other emission sources. Every new resident at the Placer Vineyards project site would be moving from an existing location where their activities are contributing to CO<sub>2</sub> emissions. It is also reasonable to expect that at least a portion of the businesses at the project site will be moving from an existing location to the project site and are not completely new business or commercial facilities. However, similar to CO<sub>2</sub> emissions from vehicles, it is not possible to calculate the net CO<sub>2</sub> emissions from other sources because information on the existing behavior of individuals or businesses that would ultimately move to the project site cannot be determined. It is unknown whether the homes project residents move into will be more or less energy efficient than their existing residences, how many and which types of businesses on the project site might be new facilities or relocations of existing facilities, and whether facilities and operations of relocated businesses might result in more or less overall CO<sub>2</sub> emissions relative to existing conditions. However, it is certain that much of the CO<sub>2</sub> emissions attributed to project residents and businesses will simply be from emissions sources that move from an existing location to the project site, not from new emissions sources relative to global climate change.

Therefore, although the estimate of 523,000 tons of CO<sub>2</sub> emitted annually from the Placer Vineyards project is very general, and is considered high, it is sufficient to support an evaluation of the project's contribution towards GHG emissions.

Applying the same emissions calculation methodology described above to the Blueprint Alternative, this alternative is estimated to generate approximately 621,000 tons of CO<sub>2</sub> per year at buildout (243,567 vehicle trips per day, 7.06 VMT per trip, transportation emissions accounting for 40.7% of total emissions). The Blueprint Alternative results in higher CO<sub>2</sub> emissions than the proposed project because the increased density of development results in more vehicle trips, while average vehicle miles per trip identified in Appendix J of the RDEIR is reduced only slightly relative to the proposed project (7.06 miles per trip versus 7.43 miles per trip).

It should also be noted that the emissions calculations described above do not take into account reductions in GHG emissions resulting from implementation of AB 32. Stationary emissions

sources on the project site and stationary sources that serve the project site (e.g., power plants) will be subject to emissions reductions requirements of AB 32. The extent of these reductions has not yet been quantified by ARB. At the time of project buildout, overall CO<sub>2</sub> emissions attributable to the Placer Vineyards project could be substantially less than current emissions assumptions might indicate. Similarly, if GHG emissions reductions for vehicles are enacted, through either the requirements of AB 1493 or AB 32 or a federal regulation, CO<sub>2</sub> emissions from the Placer Vineyards project would be further reduced. If regulations proposed to comply with AB 1493 survive current legal challenges, by project buildout CO<sub>2</sub> emissions from vehicles associated with the project could be 20% to 30% less than under current conditions. If AB 1493 is repealed, it is unclear what vehicle emissions limits might be adopted as part of AB 32.

Emissions reduction requirements associated with AB 1493 and AB 32, SB 1368 and Executive Order S-3-5 would apply throughout California. Therefore, beyond the fact that their effect on the Placer Vineyards project is unclear, their effect on the overall cumulative context relative to all GHG emissions in California is unknown.

## **IMPACT ASSESSMENT**

As described above in the "Environmental Setting" discussion (section 4.13.2), the cumulative increase in GHG concentrations in the atmosphere has resulted in and will continue to result in increases in global average temperature and associated shifts in climatic and environmental conditions. Multiple adverse environmental effects are attributable to global climate change, such as sea level rise, increased incidence and intensity of severe weather events (e.g., heavy rainfall, droughts), and extirpation or extinction of plant and wildlife species. Given the significant adverse environmental effects linked to global climate change induced by GHGs, the emission of GHGs is considered a significant cumulative impact. Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the industrial/manufacturing, utility, transportation, residential, and agricultural sectors (California Energy Commission 2006a). Therefore, the cumulative global emissions of GHGs contributing to global climate change can be attributed to every nation, region, and city, and virtually every individual on Earth. The challenge in assessing the significance of an individual project's contribution to global GHG emissions and associated global climate change impacts is to determine whether a project's GHG emissions—which, it can be argued, are at a micro scale relative to global emissions—result in a cumulatively considerable incremental contribution to a significant cumulative macro-scale impact.

In 2003 global emissions of carbon (i.e., only the carbon atoms within CO<sub>2</sub> molecules) solely from fossil fuel burning totaled an estimated 7,303 million metric tons (Marlands et al. 2006). This translates to approximately 29,400 million tons of CO<sub>2</sub>. This is only a portion of global CO<sub>2</sub> emissions because it addresses only fossil fuel burning and does not address other CO<sub>2</sub> sources such as burning of vegetation. Total estimated CO<sub>2</sub> emissions from all sources associated with the Placer Vineyards project would be less than 0.002% of this partial global total. CO<sub>2</sub> emissions in California totaled approximately 391 million tons in 2004 (California Energy Commission 2006a). Depending on the alternative selected, total CO<sub>2</sub> emissions from the Placer Vineyards project, as estimated above, would be 0.13% to 0.16% of this statewide total.

However, as noted above, the emission calculation methodology treats project emissions as if they were new emissions, and does not correct for the fact that many emission sources associated with the Placer Vineyards project could simply be moving from an existing location to the project site. Therefore, the project's net contribution of CO<sub>2</sub> to global climate change would be much less than 523,000 tons per year estimated for the proposed project and the 621,000 tons per year estimated for the Blueprint Alternative. Similarly, the project's proportion of global and statewide emissions would be less than described above.

Although it is clear that the Placer Vineyards project's net contribution of CO<sub>2</sub> to global climate change will be less than estimate above, a great deal of uncertainty exists regarding what the net CO<sub>2</sub> emissions would actually be. In addition, it is uncertain how current regulations might affect CO<sub>2</sub> emissions attributable to the project and cumulative CO<sub>2</sub> emissions from other sources in the state. Also, as described previously, it cannot be determined how CO<sub>2</sub> emissions associated with the Placer Vineyards project might or might not influence actual physical effects of global climate change. For these reasons, it is uncertain whether the Placer Vineyards project would generate a substantial increase in GHG emissions relative to existing conditions, and whether emissions from the Placer Vineyards project would make a cumulatively considerable incremental contribution to the significant cumulative impact of global climate change.

Not withstanding such uncertainty, the Placer Vineyards Specific Plan is a very large project, which if evaluated at either a local or regional scale, would emit CO<sub>2</sub> and other GHGs at much higher volumes than most other types of development. Therefore, for this analysis, a conservative approach is taken and the Placer Vineyards project is considered to potentially make a cumulatively considerable incremental contribution to the significant cumulative impact of global climate change.

## **GHG EMISSIONS IMPACTS**

4.13-1 Development of the Project could potentially result in a cumulatively considerable incremental contribution to the significant cumulative impact of global climate change.

## **MITIGATING FACTORS**

Broadly speaking, climate change mitigation and adaptation strategies fall into three categories: (1) transportation sector strategies; (2) electricity sector strategies, including renewable energy and energy efficiency; and (3) all other adaptation strategies, such as carbon sequestration, participation in emissions trading markets and research and public education (California Energy Commission 2003). The Placer Vineyards Specific Plan project incorporates guidelines, strategies and mitigation measures that minimize the human and spatial environmental footprint in the Specific Plan area, including transportation and electricity impacts. Implementation of these measures will help reduce potential GHG emissions resulting from the development of the Project.

The state's primary source of GHG emissions is the consumption of fossil energy (California Energy Commission 2003). The proposed Specific Plan has several components that would

reduce consumption of fossil energy within the Specific Plan area, and thereby reduce potential GHG emissions. These components are consistent with "smart growth" principles developed and promoted by the Sacramento Area Council of Governments (SACOG) (see Development Review Committee Staff Report (Jan. 12, 2007) to Placer County Planning Commission.)

## "SMART GROWTH" FACTORS

The proposed Specific Plan has several components that will promote the use of alternative modes of transportation that produce less greenhouse gas emissions than vehicular travel, or none at all. First, the proposed development is designed to encourage people to walk, ride bicycles, take public transportation, or carpool (see Development Review Committee Staff Report (Jan. 12, 2007) to Placer County Planning Commission). Second, the overall design and land use plan of Placer Vineyards creates a compact development pattern that encourages walking, biking, and public transit use, as well as shortens auto trips (see ibid.) Third, the Specific Plan improves the regional balance of housing and jobs. Housing opportunities are made available closer to employment to encourage fewer long distance commutes, thus reducing vehicular travel time (see ibid).

#### TRAFFIC FACTORS

Implementation of the Specific Plan's transportation and circulation goals, policies, and mitigation measures will also help reduce potential GHG emissions by soothing the flow of traffic to allow engines to operate more efficiently. By implementing measures to decrease stop-and-go driving and idling at intersections, these measures will help reduce overall fuel consumption and GHG emissions. The Project's transportation and circulation system will also promote non-vehicular travel through the implementation of traffic calming measures that will make roads safer for pedestrians and bicyclists (see International Council for Local Environmental Initiatives (ICLEI) 2001). Improvements in vehicle efficiency and alternative fuel vehicles will also help reduce GHG emissions in the project area.

#### **ELECTRICITY FACTORS**

In addition to targeting GHG emissions through the transportation sector, the proposed Specific Plan contains several goals and policies that will reduce energy consumption from power plants and non-transportation sources of fossil fuel consumption. Specific Plan policies require building design features that accommodate and encourage use of alternative energy sources and promote low-emission energy by incorporating landscaping conducive to passive solar energy uses. For example, the Specific Plan encourages buildings to be oriented in a south-to-southwest direction and for deciduous tress to be planted on the west and south sides of structures. It also specifies that landscapes should be provided with drought-resistant species and groundcovers rather than pavement to reduce heat reflection. In addition, existing measures in place through AB 32, SB 1368, and other state initiatives will help contribute to a countywide reduction of GHG emissions.

Even with implementation of the above described measures, however, the Placer Vineyards Project will likely result in a substantial amount of GHG emissions. Because it cannot be determined to a reasonable degree of certainty that the Placer Vineyards Project will not result in a cumulatively considerable incremental contribution to the significant cumulative impact of global climate change, the impacts of the proposed project on global climate change are considered *significant and unavoidable*.

## **Mitigation Measures**

Implementation of the following mitigation measure would substantially reduce greenhouse gas emissions within the Specific Plan area, *but not to a level that is less than significant*:

- 4.13-1a Implement Mitigation Measure 4.8-3, establishing guidelines for County review of future project-specific submittals for non-residential development within the Specific Plan area in order to reduce generation of air pollutants.
- 4.13-1b Implement Mitigation Measure 4.8-3b, requiring implementation measures to accomplish an overall reduction of 10 to 20% in residential energy consumption relative to the requirements of Sate of California Title 24.
- 4.13-1c Implement Mitigation Measure 4.8-3c, promoting a reduction of residential emissions.
- 4.13-1d *Implement Mitigation Measure 4.8-3e, requiring measures to promote bicycle usage.*
- 4.13-1e Implement Mitigation Measure 4.8-3f, requiring measures to promote transit usage and ride sharing.
- 4.13-1h Implement Mitigation Measure 4.8-3h, encouraging school districts to incorporate energy saving measures into the design, construction, and operation of elementary, middle and high school buildings and facilities.
- 4.13-1i Implement Mitigation Measure 4.8-3i, requiring measures to promote bicycle use, ride sharing, and commute alternatives to be incorporated into the design, construction and operation of public park areas.
- 4.13-1j Implement Mitigation Measure 4.6-3j, prohibiting open burning throughout the Specific Plan Area and requiring this prohibition in any project CC&Rs that are established.
- 4.13-1k Implement Mitigation Measure 4.7-2a-b; 4.7-5a-b, 4.7-6a-b; 4.7-12; and 4.7-13a-b, 4.7-15a-b, 4.7-16a-b, 4.7-17a-b, 4.7-19a-b, mitigating traffic impacts (see Recirculated RDEIR, July 2006).
- 4.13-11 *Implement mitigation measures 4.11.5-1a -4.11.5-1d, requiring waste diversion and recycling.*

- 4.13-1m Placer County and the project applicant shall work together to publish and distribute an Energy Resource Conservation Guide describing measures individuals can take to increase energy efficiency and conservation. The applicant shall be responsible for funding the preparation of the Guide. The Energy Resource Conservation Guide shall be updated every 5 years and distributed at the public permit counter.
- 4.13-1n The project applicants shall pay for an initial installment of Light Emitting Diode (LED) traffic lights in all Specific Plan area traffic lights.
- 4.13-10 The project applicants and Placer County shall jointly develop a tree planting informational packet to help project area residents understand their options for planting trees that can absorb carbon dioxide.
- 4.13-1p Prioritized parking within commercial and retail areas shall be given to electric vehicles, hybrid vehicles, and alternative fuel vehicles.

## 4.13.4 EFFECTS OF GLOBAL CLIMATE CHANGE ON WATER RESOURCES

Global climate change is projected to affect water resources in California. For example, an increase in the global average temperature is projected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada. Snowpack in the Sierra Nevada provides both water supply (runoff) and storage (within the snowpack before melting), and is a major source of supply for the state. Although current forecasts vary (see, e.g., DWR 2006), this phenomenon could lead to significant challenges in securing an adequate water supply for a growing population and California's agricultural industry. An increase in precipitation falling as rain rather than snow could also lead to increased potential for floods because water that would normally be held in the Sierra Nevada until spring could flow into the Central Valley concurrently with winter storm events. This scenario would place more pressure on California's levee/flood control system.

Global climate change is expected to influence many interconnected phenomena, which will in turn affect the rate of climate change itself. Faced with this overwhelmingly complex system, scientists who model climate change must make decisions about how to simplify the phenomenon, such as assuming a fixed rate of temperature change or a certain level of aerosol production or a particular theory of cloud formation. These assumptions make the models applicable to particular aspects of the changing ecosystem, given a good guess about how the future will be. Rather than try to be predictive, the models represent possible scenarios that come with a set of presuppositions. Even when results are quantified, such quantifications are meaningless unless viewed in the light of those presuppositions. For these reasons, a range of models must be examined when trying to assess the potential effects of climate change and the resulting analysis is most appropriately qualitative (See Intergovernmental Panel on Climate Change (IPCC) 2001). This section, therefore, provides a qualitative analysis of the impacts of global climate change as they affect water resources in California and in the Specific Plan area.

# CLIMATE CHANGE AND POTENTIAL IMPACTS ON CALIFORNIA WATER RESOURCES OF SIGNFICANCE TO PLACER COUNTY

From a statewide perspective, global climate change could affect California's environmental resources through potential, though uncertain, changes related to future air temperatures and precipitation and their resulting impacts on water temperatures, reservoir operations, stream runoff, and sea levels (Kiparsky and Gleick 2003). These changes in hydrological systems could threaten California's economy, public health, and environment (California Energy Commission 2003). The types of potential climate effects that could occur on California's water resources include:

- Water Supply. Several recent studies have shown that existing water supply systems are sensitive to climate change (Wood 1997). Potential impacts of climate change on water supply and availability could directly and indirectly affect a wide range of institutional, economic, and societal factors (Gleick 1997). Much uncertainty remains, however, with respect to the overall impact of global climate change on future water supplies. For example, models that predict drier conditions (i.e.., parallel climate model [PCM]) suggest decreased reservoir inflows and storage and decreased river flows, relative to current conditions. By comparison, models that predict wetter conditions (i.e., HadCM2) project increased reservoir inflows and storage, and increased river flows (Brekke 2004). Both projections are equally probable based on which model is chosen for the analyses (Ibid.). Much uncertainty also exists with respect to how climate change will affect future demand of water supply (DWR 2006). Still, changes in water supply are expected to occur and many regional studies have shown that large changes in the reliability of water yields from reservoirs could result from only small changes in inflows (Kiparsky and Gleick 2003; see also Cayan et al. 2006a).
- Surface Water Quality. Global climate change could affect surface water quality as well. Water quality is affected by several variables, including the physical characteristics of the watershed, water temperature, and runoff rate and timing. A combination of a reduction in precipitation, the shift in volume and timing of runoff flows, and the increased temperature in lakes and rivers could affect a number of natural processes that eliminate pollutants in water bodies. For example, the overall decrease in stream flows could potentially concentrate pollutants and prevent the flushing of contaminants from point sources. The increased storm flows could tax urban water systems and cause greater flushing of pollutants to the Sacramento-San Joaquin Delta and coastal regions (Kiparsky and Gleick 2003). Still, considerable work remains to determine the potential effect of global climate change to water quality.
- **Groundwater.** Little work has been done on the effects of climate change on specific groundwater basins, groundwater quality or groundwater recharge characteristics (Kiparsky and Gleick 2003). Changes in rainfall and changes in the timing of the groundwater recharge season would result in changes in recharge. Warmer temperatures could increase the period where water on the ground by reducing soil freeze. Conversely, warmer temperatures could lead to higher evaporation or shorter rainfall seasons, which could mean that soil deficits would persist for longer time periods, shortening recharge seasons. Warmer, wetter winters

would increase the amount of runoff available for groundwater recharge. This additional winter runoff, however, would be occurring at a time when some basins, particularly in Northern California, are being recharged at their maximum capacity. Reductions in spring runoff and higher evapotranspiration, on the other hand, could reduce the amount of water available for recharge. However, the extent to which climate will change and the impact of that change on groundwater are both unknown. A reduced snowpack, coupled with increased rainfall, could require a change in the operating procedures for California's existing dams and conveyance facilities (Kiparsky and Gleick 2003).

- **Fisheries and Aquatic Resources.** In California, the timing and amounts of water released from reservoirs and diverted from streams are constrained by their effects on various native fish, especially those that are listed under the federal and state endangered species acts as threatened or endangered. Several potential hydrological changes associated with global climate change could influence the ecology of aquatic life in California and have several negative effects on cold-water fish (Department of Water Resources [hereafter "DRW"] 2006). For example, if climate change raises air temperature by just a few degrees Celsius, this change could be enough to raise the water temperatures above the tolerance of salmon and trout in many streams, favoring instead non-native fishes such as sunfish and carp (DRW 2006). Unsuitable summer temperatures would be particularly problematic for many of the threatened and endangered fish that spend summers in cold-water streams, either as adults, juveniles, or both (DWR 2006). In short, climate change could significantly affect threatened and endangered fish in California. It could also cause non-threatened and non-endangered fish to reach the point where they become designated as such (DWR 2006).
- **Sea Levels.** Global climate change could cause thermal expansion of ocean waters and melting of ice from land surfaces, which in turn could cause sea levels to rise. Among the risks of sea level rise would be threats to levee integrity and tidal marshes and increased salinity in the Delta region (Kiparsky and Gleick 2003). The increased intrusion of salinity from the ocean could degrade freshwater supplies pumped from the Delta, which could require increased freshwater releases from upstream reservoirs to maintain compliance with water quality standards (DWR 2006).
- Flood Control. It is difficult to assess implications of climate change for flood frequency, in large part because of the absence of detailed regional precipitation information from climate models and because human settlement patterns and water-management choices can substantially influence overall flood risk (Kiparsky and Gleick 2003). Still, increased amounts of winter runoff could be accompanied by increases in flood event severity and warrant additional dedication of wet season storage space for flood control as opposed to supply conservation. This need to manage water storage facilities to handle increased runoff could in turn lead to more frequent water shortages during high water demand periods (Brekke 2004). It is recognized that these impacts would result in increased challenges for reservoir management and balancing the competing concerns of flood protection and water supply (DWR 2006).

• **Sudden Climate Change.** Most global climate models project that anthropogenic climate change will be a continuous and fairly gradual process through the end of this century (DWR 2006). California is expected to be able to adapt to the water supply challenges posed by climate change, even at some of the warmer and dryer projections for change. Sudden and unexpected changes in climate, however, could leave water managers unprepared and could, in extreme situations, have significant implications for California and its water supplies. For example, there is speculation that some of the recent droughts that occurred in California and the western United States could have been due, at least in part, to oscillating oceanic conditions resulting from climatic changes. The exact causes of these events are, however, unknown, and evidence suggests such events have occurred during at least the past 2000 years (DWR 2006).

## **CLIMATE CHANGE STUDIES FOR THE CENTRAL VALLEY OF CALIFORNIA**

The following survey summarizes current literature related to the impact of global climate change on water resources in California's Central Valley. For a more detailed discussion of the current literature, see Appendix A of this EIR.

# PROGRESS ON INCORPORATING CLIMATE CHANGE INTO MANAGEMENT OF CALIFORNIA'S WATER RESOURCES: PRELIMINARY CLIMATE CHANGE IMPACTS ASSESSMENT FOR CVP/SWP OPERATIONS

The California Department of Water Resources (DWR) (2006) describes progress made in integrating climate change into existing water resources planning and management techniques and methodologies. The report was prepared in response to Executive Order S-3-05 and as an opportunity to begin addressing limitations of the 2005 Update to the DWR California Water Plan. Chapters 4 and 5 are of particular relevance because they focus on climate change impacts on SWP (State Water Project) and CVP (Central Valley Project) operations and on the Delta.

The purpose of the report is to demonstrate how various analysis tools currently employed by DWR could be used to address climate change issues. As DWR (2006) explains, all results presented in the report are preliminary and incorporate several assumptions. The results reflect only a limited number of climate change scenarios and do not address the probability of each scenario. DWR (2006) cautions, therefore, that the results are not sufficient alone to provide a basis for policy decisions.

The results of this analysis suggest several climate change impacts on overall SWP and CVP operations and deliveries. In three of the four climate scenarios simulated, CVP north-of-Delta reservoirs experienced shortages during droughts. DWR (2006) recommends that future studies examine operational changes that could avoid these shortages. At present, concludes DWR, it is not clear whether such operational changes would be insignificant or substantial. The study also found that changes in annual average SWP south-of-Delta Table A deliveries ranged from a slight increase of about 1% for a wetter scenario to about a 10% reduction for one of the drier scenarios. Under the three drier scenarios, increased winter runoff and lower Table A allocations resulted in somewhat higher annual average Article 21 deliveries. The increase in Article 21 deliveries did not fully offset losses to Table A. In contrast, the wetter scenario with higher Table

A allocations results in fewer Article 21 delivery opportunities and decreased annual average Article 21 deliveries. Changes in annual average CVP south-of-Delta deliveries ranged from increases of about 2.5% for the wetter scenario and decreases of up to 10 % for drier scenarios. Future studies will have to address how north-of-Delta shortages could impact south-of-Delta CVP deliveries. For both the SWP and CVP, carryover storage (i.e. water stored from one year over the next) was negatively affected in the drier scenarios and slightly increased in the wetter scenario.

## Climate Warming and Water Management Adaptation for California

Tanaka et al. (2006) explore the ability of California's water supply system to adapt to long-term climatic and demographic changes using the California Value Integrated Network (CALVIN), a statewide economic-engineering optimization model of water supply management. The results show agricultural water users in the Central Valley are the most sensitive to climate change, particularly under the driest and warmest scenario (i.e. PCM 2100) predicting a 37% reduction of Valley agricultural water deliveries and a rise in Valley water scarcity costs by \$1.7 billion. Though the results of the study are only preliminary, they suggest that California's water supply system appears "physically capable of adapting to significant changes in climate and population, albeit at a significant cost." Such adaptation would entail changes in California's groundwater storage capacity, water transfers, and adoption of new technology.

# Simulated Hydrologic Responses to Climate Variations and Change in the Merced, Carson, and America River Basins, Sierra Nevada, California, 1900-2099

Hydrologic responses of river basins in the Sierra Nevada to historical and future climate changes are assessed by Dettinger et al. (2004). A historical run showed stationary climate and hydrologic variations through the first part of the 20th century until roughly 1975 when temperatures began to warm noticeably and snowmelt and snowflow peaks began to occur progressively earlier. A business-as-usual run showed a continuance of the historical trend though the 21st century with an attendant +2.5°C warming and a hastening of snowmelt and streamflow within the seasonal cycle by almost one month. In contrast, the future control run, in which GHG concentrations were fixed at 1995 levels, showed climate and streamflow timing conditions very similar to those of the 1980s and 1990s throughout its duration.

# Potential Implications of PCM Climate Change Scenarios for Sacramento-San Joaquin River Basin Hydrology and Water Resources

VanRheenen et al. (2004) study the potential effects of climate change on the hydrology and water resources of the Sacramento-San Joaquin River Basin using five PCM scenarios. The study concludes that most mitigation alternatives examined satisfied only 87 to 96% of environmental targets in the Sacramento system, and less than 80% in the San Joaquin system. Therefore, system infrastructure modifications and improvements could be necessary to accommodate the volumetric and temporal shifts in flows predicted to occur with future climates in the Sacramento-San Joaquin River basins.

## Estimated Impacts of Climate Warming on California Water Availability Under Twelve Future Climate Scenarios

Zhu et al (in press) study climate warming impacts on water availability derived from modeled climate and warming streamflow estimates for six index California basins and distributed statewide temperature shift and precipitations changes for 12 climate scenarios. The index basins provide broad information for spatial estimates of the overall response of California's water supply and the potential range of impacts. The results identify a statewide trend of increased winter and spring runoff and decreased summer runoff. Approximate changes in water availability are estimated for each scenario, though without operations modeling. Even most scenarios with increased precipitation result in a decrease in available water. This result is due to the inability of current storage systems to catch increased winter streamflow to offset reduced summer runoff.

#### Trends in Snowfall versus Rainfall in the Western United States

To better understand the nature of the observed changes in snowpack and streamflow timing in the west, Knowles et al. (2006) address historical changes in the relative contributions of rainfall and snowfall. The study documents a regional trend toward smaller ratios of winter-total snowfall water to winter-total precipitation during the period of 1949-2004. The trends toward decreased winter-total snowfall are a response to warming across the region, with the most significant decreases occurring where winter wet-day minimum temperatures were on average warmer than -5° over the study period. The authors suggest that, if warming trends continue, the snowfall fraction of precipitation is likely to continue to decline, which combined with earlier melting of the remaining accumulations of snowpack, will diminish the West's natural freshwater storage capacity. This trend could, in turn, exacerbate tensions between flood control and storage priorities that many western reservoir managers face.

# Climate Change Impacts on Water for Agriculture in California: A Case Study in the Sacramento Valley

Joyce et al. (2006) employ the Water Evaluation and Planning (WEAP) system, a hydrologic model that was developed for the Sacramento River Basin. The study found that increasing temperatures could put a strain on the basin's water resources. Assuming an increasing urban demand for water, the effects of climate change could be mitigated if the agricultural sector adapts to the new environment. The authors considered the effect of increased irrigation efficiency and shifts in cropping and found that groundwater pumping between 2070 and 2100 was reduced when these practices were adopted.

## Climate Warming and Water Supply Management in California

Medellin et al. (2006) use the CALVIN model under a high emissions "worst case" scenario, called a dry-warming scenario. The study found that climate change would reduce water deliveries 17% in 2050. The reduction in deliveries was not equally distributed, however, between urban and agricultural areas. Agricultural areas would see their water deliveries drop by

24% while urban areas would only see a reduction of 1%. There was also a geographic difference: urban scarcity was almost absent outside of southern California.

## **Climate Scenarios for California**

Cayan et al. (2006b) consider two GHG emissions scenarios, a medium-high and a low. The study found that California will experience a warming trend from 2000 to 2100, with temperatures rising between 1.7 and 5.8° C, depending on the model and the scenario chosen. This increase in temperature could potentially impact snowpack levels as the state experiences less snow and more rain. The results also indicate that snowpack in the Sierra Nevada could be reduced 32 to 79%, depending on the model and scenario chosen. The study does not consider the ability of California's water supply system to adapt to these potential changes.

# Our Changing Climate - Assessing the Risks to California, California Climate Change Center 2006 Biennial Report

In 2003, the California Energy Commission's Public Interest Energy Research (PIER) program established the California Climate Change Center (CCCC) to conduct climate change research relevant to the state. Executive Order S-3-05 called for the CalEPA to prepare biennial science reports on the potential impact of continued climate change on certain sectors of California's economy. CalEPA entrusted PIER and its CCCC to lead this effort. The climate change analysis contained in its first biennial science report is the product of a multi-institution collaboration among the California Air Resources Board, DWR, CEC, CalEPA and the Union of Concerned Scientists.

With respect to the most severe consequences of global climate change on California's water supplies, the study concludes that major changes in water management and allocation systems could be required in order to adapt to the change. As less winter precipitation falls as snow, and more as rain, water managers would have to balance the need to construct reservoirs for water supply with the need to maintain reservoir storage for winter flood control. Additional storage could be developed, but at high environmental and economic costs.

## Climate Warming & California's Water Future

Lund et al. (2003) examine the effects of a range of climate warming estimates on the long-term performance and management of California's water system. The study estimates changes in California's water availability, including effects of forecasted changes in 2100 urban and agricultural water demands using a modified version of the CALVIN model. The main conclusions are summarized as follows:

 Methodologically, it is useful and realistic to include a wide range of hydrologic effects, changes in population and water demands, and changes in system operations in climate change studies;

- A broad range of climate warming scenarios show significant increase in wet season flows and significant decreases in spring snowmelt. The magnitude of climate change effects on water supplies is comparable to water demand increases from population growth in twenty-first century;
- California's water system would be able to adapt to the severe population growth and climate change modeled. This adaptation would be costly, but it would not threaten the fundamental prosperity of the state, although it could have major impacts on the agricultural sector. The water management costs represent only a small proportion of California's current economy.
- Under the driest climate warming scenarios, Central Valley agricultural users could be quite vulnerable to climate change. Wetter hydrologies could increase water availability for these users. The agricultural community would not be compensated for much of its loss under the dry scenario. The balance of climate change effects on agricultural yield and water use is unclear. While higher temperatures could increase evapotranspiration, longer growing seasons and higher carbon dioxide concentrations could increase crop yield.
- Population growth is expected to be more problematic than climate change in Southern California. Population growth, conveyance limits on imports, and high economic value of water in Southern California, could lead to high use of wastewater reuse and substantial use of seawater desalination along the coast.
- Under some wet warming climate scenarios, flooding problems could be substantial. In certain cases, major expansions of downstream floodways and alterations in floodplain land use could become desirable.
- California's water system could economically adapt to all the climate warming scenarios examined in the study. New technologies for water supply, treatment, and water use efficiency, implementation of water transfers and conjunctive use, coordinated operation of reservoirs, improved flow forecasting, and the cooperation of local regional, state and federal government can help California adapt to population growth and global climate change. Even if these strategies are implemented, however, the costs of water management are expected to be high and there is likely to be less "slack" in the system compared to current operations and expectations.

## 4.13.5 IMPACTS AND MITIGATION MEAUSRES

## STANDARDS OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, Placer County has determined that a significant environmental impact could occur if the proposed Specific Plan would:

• Require or result in the construction of new water treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

- Have insufficient water supplies available to serve the project from existing entitlements and resources, or new or expanded entitlements are needed.
- Substantially deplete groundwater supplies.
- Be inconsistent with the goals and policies of the adopted *Placer County General Plan*.
- Be inconsistent with the applicable terms of the Water Forum Agreement (WFA) (January 2000).

Evaluation of impacts related to the source of the proposed surface water supply and hydrologically related impacts are contained in Section 4.3 of the Revised Draft EIR (RDEIR). Evaluation of water supply impacts related to public services/infrastructure is contained in section 4.11 of the RDEIR.

# 4.13-2 The impacts of global climate change on water supply and availability could affect future water supply and availability in the Specific Plan area.

Because considerable uncertainty remains with respect to the overall impact of global climate change on future water supply in California, it is unknown to what degree global climate change will impact future Placer County water supply and availability. However, based on consideration of the recent regional and local climate change studies described in the literature review above, and based on an assessment of water supply under both the Base Plan and the Blueprint Alternative, it is reasonably expected that the impacts of global climate change on water supply would be *less than significant* under either alternative. Because the Blueprint Alternative would create a greater demand for water, however, global climate change poses a greater threat to water supply in the Project area under the Blueprint Alternative than under the Placer Vineyards Specific Plan.

As described by the literature survey above, overall, climate change is expected to have a greater effect in Southern California and agricultural users than urban users in the Sacramento Valley/Sierra Nevada area. For example, for 2020 conditions, where optimization is allowed (i.e., using the CALVIN model), scarcity is essentially zero in the Sacramento Valley for both urban and agricultural users, and generally zero for urban users in the San Joaquin and Tulare Basins. Rather, most water scarcity will be felt by agricultural users in Southern California, though Southern California urban users, especially Coachella urban users, will also experience some scarcity. By the year 2050, urban water scarcity will remain almost entirely absent north of the Tehachapi Mountains, although agricultural water scarcity could increase in the Sacramento Valley to about 2% (Medellin et al. 2006; see also Tanaka et al. 2006 and Lund et al. 2003 for further discussion of global climate change impacts on agricultural uses).

Based on the conclusions of current literature regarding California's ability to adapt to global climate change, it is reasonably expected that, over time, the State's water system will be modified to be able to handle the projected climate changes, even under dry and/or warm climate scenarios (DRW 2006). Although coping with climate change effects on California's water

supply could come at a considerable cost, based on a thorough investigation of the issue, it is reasonably expected that statewide implementation of some, if not several, of the wide variety of adaptation measures available to the state, will likely enable California's water system to reliably meet future water demands. For example, traditional water supply reservoir operations may be used, in conjunction with other adaptive actions, to offset the impacts of global warming on water supply (Medellin et al. 2006; see also Tanaka et al. 2006 and Lund et al. 2003). Other adaptive measures include better urban and agricultural water use efficiency practices, conjunctive use of surface and ground waters, desalination, and water markets and portfolios (Medellin et al. 2006; see also Lund et al. 2003, Tanaka et al. 2006). More costly statewide adaptation measures could include construction of new reservoirs and enhancements to the state's levee system (California Energy Commission 2003). As described by Medellin et al. 2006, with adaptation to the climate, the water deliveries to urban centers are expected to decrease by only 1%, with Southern California shouldering the brunt of this decrease.

Although California could potentially experience an increased number of single-dry and multiple-dry years as a result of global climate change, based on current knowledge, it is reasonably expected that such increase would not significantly affect the ability of the Placer County Water Agency (PCWA) to reliably meet the Project's build-out water demands. As described by the PCWA Integrated Water Resources Plan (IWRP) (Attachment A to the Placer Vineyards Specific Plan Final EIR), PCWA's use of an integrated resources approach will ensure that there is adequate water supply to reliably meet all the projected PCWA western Placer County service area demands, including those of the proposed Project, even under single-year and multiple year drought conditions.<sup>1</sup>

Importantly, each of PCWA's surface water supply entitlements for use in western Placer County has historically demonstrated a high reliability during even multiple-dry years. PCWA's first source of surface water supply is a water supply contract with PG&E for 100,400 acre feet annually (afa) of Yuba/Bear River Water that is delivered through PG&E's Drum Spaulding hydro system. This source of water has a high reliability during normal, single-dry, and multipledry years. For example, between 1987 and 1992, California experienced five years of drought, during which many areas in the state had reduced supplies. During that period, PCWA had a full Yuba/Bear River supply each year. Indeed, the only year in which PCWA had to impose drought restrictions on its customers due to reduced PG&E supply was 1977, the driest single year in California's measured hydrologic record (2006 RDEIR, Attachment M). PCWA's second source of water supply (i.e., Middle Fork Project water rights) also has high reliability during even multiple-dry years (see 2006 RDEIR, Attachment M). Finally, the Agency's third source of surface water (i.e., its federal CVP Municipal and Industrial water supply contract), currently anticipated to be exercised on the Sacramento River, should also be a reliable source of water because under the Agency's Integrated Water Resources Plan, the Agency plans to supplement its CVP contract supply with groundwater in dry years to improve reliability to the point where

<sup>&</sup>lt;sup>1</sup> Although the IWRP does not specifically address the effects of global climate change on Placer County's water supply, the IWRP, together with the water supply analysis contained in the 2006 RDEIR, represent the best available information regarding the effects of single-dry and multiple-dry years on Placer County water supply. For that reason, this analysis relies on the IWRP and the RDEIR, in addition to the climate change studies described in this report.

the full contract amount can be relied upon to serve urban development needs (see RDEIR Appendix M; see also Final EIR Appendix A, see below for a discussion of climate change impacts on groundwater supply).

In addition, PCWA's surface water supply entitlements are unlikely to be affected by global climate change because, as indicated by preliminary results from DWR (2006), water supply impacts from climate change would be largely reflected in reduced south-of-Delta exports, while existing Delta water quality requirements would continue to be satisfied. It is therefore reasonable to consider that global climate change may have relatively less effect on the Placer County water supply because the PCWA's surface water supplies are based on existing water rights and contract entitlements for in-basin use above the Delta.

Based on current knowledge, global climate change is also not expected to significantly impact groundwater supply for the Specific Plan area. Western Placer County lies within the northeastern section of the North American Groundwater sub-basin, which lies in the eastern central portion of the Sacramento Groundwater Basin. Preliminary studies indicate that the Sacramento Valley would experience only a small decline in groundwater levels as a result of global climate change (Vicuña 2006). Although groundwater may be used to supplement surface water supply to the Specific Plan area during dry years, it is unlikely that such future groundwater pumping would exceed safe yield. The PCWA integrated water resources strategy anticipates that groundwater pumping would not exceed safe yield as long as the long-term (multiple years) average does not exceed 95,000 ac-ft/yr (Final EIR Appendix A). Although, as discussed above, there is still a great deal of uncertainty in respect to impacts of climate change on future groundwater availability in California, in view of the high reliability of PCWA surface water supplies and the wide variety of integrated water management techniques available to PCWA, long-term average groundwater pumping in not reasonably expected exceed the 95,000 ac-ft/yr average. Moreover, the planned replacement of agricultural lands in western Placer County with urban development is expected to result in an in-lieu groundwater recharge, thereby further reducing the likelihood of a groundwater overdraft (Final EIR Appendix A). The impacts of global climate change on groundwater in western Placer County are, therefore, reasonably considered less than significant.

For these reasons, impacts of global climate change on water supply for proposed Project are considered *less than significant*.

## Mitigation Measure

No mitigation measures required.

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