3.17

GREENHOUSE GAS EMISSIONS (GLOBAL CLIMATE CHANGE)

3.17 Greenhouse Gas Emissions (Global Climate Change)

This section considers the impacts of proposed new land uses within the City of Merced General Plan boundary on greenhouse gas emissions and global climate change, as well as climate change impacts to water supply. The land uses that are proposed by the 2030 General Plan that will result in increased generation of CO_2 (a principal greenhouse gas contributing to global climate change) at full build out are as follows:

Proposed additional General Plan areas outside Existing General Plan area, within the SUDP/SOI:

- Total Rural Res: 1824.56 acres;
- Total Single-Family Res: 321.04 acres;
- Total Multi-Family: 57.24 acres;
- Total Office: 39.82 acres;
- Total Industrial: 1072.34 acres;
- Total Business Park: 77.43 acres;
- Total Commercial: 196.76 acres;
- Total Open Space: 287.09 acres;
- Total Schools: 994.18 acres; and
- Total Community Plan Areas: 7955.39 acres.

Figure 2-4 shows the proposed land uses included in the 2030 General Plan Update.

Global Warming Impacts and Causes

Climate change is recognized throughout the world to be one of the most daunting and controversial subjects of our time. Human activities are altering the chemical composition of the atmosphere through the rapid buildup of climate change emissions, primarily carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons. According to scientific studies, concentrations of these gasses in the ambient atmosphere are increasing at a rate not experienced for millions of years, although there is some uncertainty about exactly how and when the earth's climate will respond to increasing concentrations of climate change emissions, observations, in conjunction with climate models, indicate detectable changes are underway.

These observed changes go beyond a global mean rise in temperature and include changes in regional temperature extremes, precipitation, soil moisture, and sea level. All of these changes could have significant adverse effects on water resources and ecological systems, as well as on human health and the economy. Implementation of precautionary and proactive measures is imperative if climate change emissions are to be reduced and communities are to adapt successfully to the adverse impacts.

Research suggests that human activities, such as the burning of fossil fuels and clearing of forests, contribute additional carbon dioxide (CO_2) 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. Projected effects of climate change on California include:

- Increased air pollution
- Intensified heat waves
- An expanded range of infectious diseases
- A decline in the Sierra Nevada snow pack, with resulting impacts on water supply, ecosystems and hydropower
- A range of agriculture impacts, including expanded ranges for weeds and pests, and a decrease in chill hours required by some of the state's crops
- A rise in sea level and more severe storm events increasing coastal flooding
- Increased flooding in river delta and floodplain areas
- An increase in the risk of large wildfires.

Actions to Reduce Global Warming

California has taken actions to reduce climate change emissions. The California Energy Commission has adopted energy efficiency standards for buildings and appliances that are extremely stringent. CARB has adopted vehicle climate change standards that are the first of their kind in the United States. The State's Renewable Portfolio Standard was accelerated by the Governor to require by 2010 that 20 percent of all power used in California be generated by renewable resources. The California Public Utilities Commission recently adopted a Solar Building Initiative that continues California's progressive approach to economic growth and technological innovation hand in hand with protection of public health and the environment. Executive Order S-3-05 signed by the Governor on June 1, 2005, established statewide climate change emission reduction targets as follows:

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

The Governor signed Executive Order S-01-07 on January 18, 2007, establishing carbon reduction targets as follows:

- By 2020, reduce carbon intensity in California transportation fuels by at least 10 percent
- In 2006 the Legislature adopted AB 32 as California's "Global Warming Solutions Act" to begin the process of reversing the causes of global warming. (See Chapter 488 Statutes of 2006). This measure directs CARB to develop a statewide greenhouse gas (GHG) emissions

cap for 2020 and to develop and implement regulations and market mechanisms to reduce GHG emissions.

Beyond the established statewide goals on emission reductions and caps, other state and regional agencies are developing strategies for incorporating energy efficiency and climate change emissions reduction measures into the policy framework governing land use and transportation. Some local air districts have begun to incorporate climate protection objectives into their ongoing local programs.

3.17.1 SETTING

Environmental Setting

EXISTING 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_2), methane (CH_4), ozone (O_3), water vapor, nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for enhancing the greenhouse effect. 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. *Inventory of California Greenhouse Gas Emissions and Sinks 1990 to 2004.* 2006a. http://www.energy.ca.gov/2006publications/CEC-600-2006-013/CEC-600-2006-013-SF.PDF, hereafter referred to as (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_2. Methane, a highly potent GHG, results from offgassing associated with agricultural practices and landfills. Processes that absorb and accumulate CO_2, often called CO_2 "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. According to the California Energy Commission 2006a, Page 17, California is the 16th largest emitter of CO_2 in the world and produced 492 million gross metric tons of carbon dioxide equivalents in 2004. Carbon dioxide equivalents are a measurement used to account for the fact that different GHGs have different potentials 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_4 is a much more potent GHG than CO_2. As described in the General Reporting Protocol of the California Climate Action Registry (2006), one ton of CH_4 has the same contribution to the greenhouse effect as approximately 21 tons of CO_2. 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_2 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 percent 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 out-of-state sources) at 22.2% and the industrial sector at 20.5% (California Energy Commission 2006a).

In 2003, global emissions of carbon (i.e., only the carbon atoms within CO_2 molecules) solely from fossil fuel burning totaled an estimated 7,303 million metric tons. This translates to approximately 29,400 million tons of CO_2. This is only a portion of global CO_2 emissions because it addresses only fossil fuel burning and does not address other CO_2 sources such as burning of vegetation. CO_2 emissions in California totaled approximately 391 million tons in 2004 (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_4 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 Setting

FEDERAL

In a 5-4 opinion issued on April 2, 2007, the United States Supreme Court concluded, in *Massachusetts, et al. v. Environmental Protection Agency*, that "greenhouse gases fit well within the Clean Air Act's definition of 'air pollutant,'" and held that "EPA has the statutory authority to regulate the emission of such gases from new motor vehicles."

In that case, petitioners (states including California and New York, several cities, and American Samoa) with the support of several environmental organizations, requested that EPA regulate greenhouse gas emissions (primarily carbon dioxide) from new vehicles under section 202(a)(1) of the Federal Clean Air Act. Based on policy considerations and a conclusion by the National Research Council (an arm of the National Academy of Sciences) that it "cannot be unequivocally established" whether a "causal linkage" existed between global warming and greenhouse gas emissions, the EPA Administrator denied the rulemaking petition.

The District of Columbia Circuit upheld the denial, holding that "the EPA Administrator properly exercised his discretion under section 202 (a)(1)" and that the Administrator's decision not to regulate was consistent with other case law which allowed such decisions to be based on policy judgments where the issues to be resolved are "on frontiers of scientific knowledge."

The Supreme Court disagreed, saying that "EPA has offered no reasoned explanation for its refusal to decide whether greenhouse gases cause or contribute to climate change." "Once EPA has responded to a petition for rulemaking," the Court said, "its reasons for action or inaction must conform to the authorizing statute" and "EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some

reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do."

The matter has been remanded, and it remains to be seen whether EPA will simply articulate a more detailed explanation for declining to regulate or begin a rulemaking process to regulate greenhouse gas emissions from motor vehicles. In the meantime, a variety of climate change-related bills have been introduced in the United States House of Representatives and Senate, that, if enacted, would likely result in additional statutory direction to EPA and other federal agencies regarding the regulation of greenhouse gases from motor vehicles and stationary sources.

In spite of the Supreme Court's recent ruling in *Massachusetts v. EPA* holding that EPA has authority to regulate greenhouse gas emissions from new motor vehicles, greenhouse gases are not currently regulated under the Federal Clean Air Act. Potential greenhouse gas legislation and/or EPA rulemaking processes could take several years to become effective. Nonetheless, at least one federal district court has held that where carbon dioxide emissions from a project could result in environmental impacts, NEPA requires analysis of those impacts [*Border Power Plant Working Group v. Department of Energy* (S.D. Cal. 2003) 260 F.Supp.2d 997].

STATE

At the time of this writing, there are no regulations setting ambient air quality emissions standards for greenhouse gases; however, it is anticipated that such will be developed in the near future in accordance with the following recently enacted California legislation and Executive Order S-3-05 as described below.

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 (Cal EPA) 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 Cal EPA created a "Climate Act Team" (CAT). In March 2006, Cal EPA released a report on behalf of the CAT (comprised of cabinet secretaries and policy makers from Cal EPA, CEC, CARB, CPUC, CIWMB, Caltrans, the Department of Food and Agriculture, and the Governor's office). Among other things, the "CAT Report" outlined the principles of climate change science that formed the basis for the evaluation of potential climate-change related impacts that could occur in California. The report cited the International Panel on Climate Change (IPCC) and other sources to conclude that global temperatures are increasing and that human activities are contributing to the build-up of climate change pollutants. The report also summarized potential effects of climate change based on three IPCC scenarios and described potential emission reduction strategies.

Assembly Bill 32, California Global Warming Solutions Act of 2006

California has enacted Assembly Bill 32 (AB 32), effective January 1, 2007, to cap carbon dioxide emissions in an effort to address one of the sources of global warming concern. AB 32 directs the California Air Resources Board ("CARB") to require reporting and verification of current greenhouse gas emissions (defined as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) and to estimate 1990 greenhouse gas emissions levels prior to January 1, 2008 (Health and Safety Code §§ 38530, 38550). CARB must then adopt a statewide greenhouse gas emissions limit equal to the approved 1990 emissions levels and set a reduction schedule and adopt regulatory programs to achieve the target levels by 2020. The law focuses on reducing emissions to "maximum technologically feasible and cost-effective levels" (Health and Safety Code § 38560). CARB was charged with publishing a list of early action greenhouse gas emission reduction measures by June 30, 2007, and adopting regulations to implement those early action measures by January 1, 2010, while final regulations for greenhouse gas emission limits and emission reduction measures must be adopted by January 1, 2011 and become operative by January 1, 2012 (Health and Safety Code §§ 38560.5, 38562).

CARB may establish market-based compliance mechanisms (e.g. a "cap and trade" system) allowing emitters to purchase, bank or trade greenhouse gas "allowances" from third parties and/or may adopt a declining annual aggregate emissions limitation (Health and Safety Code §§ 38505(k), 38562(c), 38570 et seq). Under extraordinary circumstances, or in cases of catastrophic events or threat of economic harm, AB 32 allows the Governor to extend deadlines for adoption of regulations mandated by AB 32 for up to one year at a time (Health and Safety Code § 38599(a)).

In a CARB presentation at a February 27, 2007 public workshop discussing initial regulatory concepts for mandatory greenhouse gas emissions reporting under AB 32, cement manufacturers, electric power generation, oil refineries, industrial/commercial combustion, oil and gas production, and landfills were listed as potential covered sources. Of note, the presentation stated that other sources may be considered for mandatory reporting.

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 base load 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 base load 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.

No air district in California 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.

Senate Bill 97

SB 97 (Chapter 185, Statutes 2007) was signed by Governor Schwarzenegger on August 24, 2007. The legislation provides partial guidance on how greenhouse gases should be addressed in certain CEQA documents. SB 97 requires the Governors Office of Planning and Research (OPR) to prepare CEQA guidelines for the mitigation of GHG emissions, including but not limited to, effects associated with transportation or energy consumption. OPR must prepare these guidelines and transmit them to the Resources Agency by July 1, 2009. The Resources Agency must then certify and adopt the guidelines by January 1, 2010. OPR and the Resources Agency are required to periodically review the guidelines to incorporate new information or criteria adopted by ARB pursuant to the Global Warming Solutions Act, scheduled for 2012.

In June 2008, OPR released a technical advisory on CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review as interim recommendations while the official OPR CEQA Guidelines were under development. In January 2009, OPR released its draft CEQA Guideline amendments and additions, which include suggested thresholds of significance and mitigation measures to address global climate change.

Assembly Bill 170

AB 170 was adopted by state lawmakers in 2003 creating Government Code Section 65302.1 which requires cities and counties in the San Joaquin Valley to amend their general plans to include data and analysis, comprehensive goals, policies and feasible implementation strategies designed to improve air quality. These amendments are due no later than one year from the due date specified for the next revisions of a jurisdiction's housing element

As required in Section 65302.1.b, cities and counties within the San Joaquin Valley must amend the general plan to include a discussion of the status of air quality and strategies to improve air quality. The elements to be amended include, but are not limited to, those elements dealing with land use, circulation, housing, conservation, and open space. Section 65302.1.c identifies four (4) areas of air quality discussion required in these amendments. These areas include: (1) a report describing local air quality conditions, attainment status, and state and federal air quality and transportation plans; (2) a summary of local, district, state, and federal policies, programs, and regulations to improve air quality; (3) a comprehensive set of goals, policies, and objectives to improve air quality; and (4) feasible implementation measures designed to achieve these goals.

Senate Bill 375

SB 375 was signed by Governor Schwarzenegger on September 30, 2008. The bill provides means to further reduce greenhouse gas (GHG) emissions from passenger vehicles and light trucks. The intent of the bill is to connect land use planning with transportation policy, resulting in more sustainable and environmentally friendly communities. The bill requires Metropolitan Planning Organizations (MPOs) to prepare a Sustainable Communities Strategy (SCS) within their Regional Transportation Plans (RTPs) which sets forth a vision for growth for the region taking into account the transportation, housing, environmental, and economic needs of the region, with the goal of reducing the number of miles traveled by personal vehicles, and thus reducing GHG emissions. Under the law, the California Air Resources Board has two years to give each of California's MPO a GHG emissions reduction target for cars and light trucks. However this target to reduce GHG from cars and light trucks can only be implemented through changes in development pattern of the MPO.

The GHG emissions reduction targets for each region are required to be established no later than September 30, 2010. Once the GHG emissions reduction targets for each region have been established, SB 375 requires the MPOs to prepare a Sustainable Communities Strategy (SCS) in their Regional Transportation Plan. While there is no deadline for adoption of the SCS, it is anticipated that the first plans would not be released until 2011, at the earliest. The SCS sets forth a development pattern for the region, which, when integrated with the transportation network and other transportation measures and policies, would reduce GHG emissions from transportation (excluding goods movement). The SCS is meant to provide individual jurisdictions with growth strategies that, when taken together, achieve the regional GHG emissions reduction targets. However, the SCS does not require that local general plans, specific plans, or zoning be consistent with the SCS but provides incentives for consistency for governments and developers. If the SCS is unable to achieve the regional GHG emissions reduction targets, then the MPO is required to prepare an Alternative Planning Strategy that shows how the GHG emissions reduction target could be achieved through alternative development patterns, infrastructure, and/or transportation measures.

LOCAL

San Joaquin Valley Air Pollution Control District

The San Joaquin Valley Air Pollution Control District (SJVAPCD) has adopted guidelines for addressing greenhouse gas impacts in its *Guidance for Valley Land Use Agencies in Addressing*

GHG impacts for New Projects Under CEQA (2009). The guidance relies on performance-based standards, otherwise known as Best Performance Standards (BPS), to assess significance of project-specific GHG emissions on global climate change during the environmental review process. Projects implementing BPS's would be determined to have a less than cumulatively significant impact. Projects can also demonstrate compliance with the requirements of AB 32 by demonstrating that their emissions achieve a 29% reduction below "business as usual" levels.

To be determined to have a less than significant individual and cumulative impact on global climate changes, projects must be determined to have reduced or mitigated GHG emissions by 29% below "business as usual" conditions, consistent with GHG emission reduction targets established by the AB 32 Scoping Plan.

Projects meeting one of the following would have a less than significant impact on global climate change:

- Exempt from CEQA;
- Complies with an approved GHG emission reduction plan or GHG mitigation program;
- Project achieves 29% GHG reductions by using approved Best Performance Standards; and
- Project achieves AB 32 targeted 29% GHG reductions compared with "business as usual".

General Plan Consistency

The *Merced Vision 2030 General Plan* contains a number of policies that apply to global climate change impacts in conjunction with ultimate build-out of the City in accordance with the General Plan. The specific policies listed below contained in the Urban Expansion, Land Use, Transportation and Circulation, Public Services and Facilities, Urban Design, Open Space, Conservation, and Recreation, Sustainable Development and Housing Elements of the General Plan are designed to ensure that global climate change impacts are minimized as development occurs in accordance with the *Merced Vision 2030 General Plan.*

Urban Expansion Policies:

UE-1.2 Foster compact and efficient development patterns to maintain a compact urban form.

Land Use Policies:

L-1.7 Encourage the location of multi-family developments on sites with good access to transportation, shopping, employment centers, and services.

L-2.4 Provide a range of services adjacent to and within industrial areas to reduce auto trips.

L-2.6 Provide neighborhood commercial centers in proportion to residential development in the City.

L-2.7 Locate and design new commercial development to provide good access from adjacent neighborhoods and reduce congestion on major streets.

L-3.1 Create land use patterns that will encourage people to walk, bicycle, or use public transit for an increased number of their daily trips.

L-3.2 Encourage infill development and a compact urban form.

L-3.3 Promote site designs that encourage walking, cycling, and transit use.

Transportation and Circulation Policies:

T-1.5 Minimize unnecessary travel demand on major streets and promote energy conservation.

T-1.6 Minimize adverse impacts on the environment from existing and proposed road systems.

T-2.2 Support and enhance the use of public transit.

T-2.3 Support a safe and effective public transit system.

T-2.4 Encourage the use of bicycles.

T-2.5 Provide convenient bicycle support facilities to encourage bicycle use.

T-2.6 Maintain and expand the community's existing bicycle circulation system.

T-2.7 Maintain a pedestrian-friendly environment.

T-2.8 Improve planning for pedestrians.

T-2.9 Ensure that new development provides the facilities and programs that improve the effectiveness of Transportation Control Measures and Congestion Management Programs.

T-3.5 Support enhanced railroad passenger service and high speed rail service for Merced.

T-3.6 Retain and expand as needed rail facilities serving industrial development.

Public Services and Facilities Policies:

P-4.2 Consider the use of reclaimed water to reduce non-potable water demands whenever practical.

P-6.1 Establish programs to recover recyclable materials and energy from solid wastes generated within the City.

Urban Design Policies:

UD-1.1 Apply Transit-Ready Development or Urban Village design principles to new development in the City's new growth areas.

UD-1.2 Distribute and design Urban Villages to promote convenient vehicular, pedestrian, and transit access.

UD-1.4 Promote and facilitate Urban Village residential area design principles**.**

UD-2.1 Use Urban Village design concepts in neighborhood revitalization programs.

Open Space, Conservation, and Recreation Policies:

OS-1.4 Improve and expand the City's urban forest.

OS-3.2 Maintain and expand the City's Bikeway and Trail System.

Sustainable Development Policies:

SD-1.1 Accurately determine and fairly mitigate the local and regional air quality impacts of projects proposed in the City of Merced.

SD-1.2 Coordinate local air quality programs with regional programs and those of neighboring jurisdictions.

SD-1.3 Integrate land use planning, transportation planning, and air quality planning for the most efficient use of public resources and for a healthier environment.

SD-1.4 Educate the public on the impact of individual transportation, lifestyle, and land use decisions on air quality.

SD-1.5 Provide public facilities and operations which can serve as a model for the private sector in implementation of air quality programs.

SD-3.1 Promote the use of Solar Energy technology and other Alternative Energy Resources.

SD-3.2 Encourage the use of energy conservation features, low-emission equipment, and alternative energy sources for all new residential and commercial development.

Housing Policies (Adopted 2004):

H-1.1 Support increased densities in residential areas.

H-2.2 Promote preventative maintenance and energy conservation in older housing units.

3.17.2 THRESHOLDS OF SIGNIFICANCE

No air district in California, including the San Joaquin Valley Air Pollution Control 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_2 into the atmosphere is not itself an adverse environmental effect. It is the increased concentration of CO_2 in the atmosphere resulting in global climate change and the associated consequences of climate change that results in adverse environmental effects (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_2 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_2 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 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.

Appendix G of the CEQA Guidelines have identified the following significance criteria pertaining to the impact of Global Warming:

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

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

Under the proposed Guidelines criteria greenhouse gas emissions should be addressed if either of the above applies. Criteria a. would be applicable to the implementation of the General Plan due

to the magnitude of development resulting in a substantial increase in GHG emissions over time relative to present conditions.

3.17.3 IMPACTS AND MITIGATION MEASURES

Emissions of Greenhouse Gases from the Plan

GHG emissions associated with the Project were estimated using CO_2 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_2 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_2. For example, as stated previously, 1 lb of methane has an equivalent global warming potential of 21 lb of CO_2 (CalEPA. *Climate Action Team Report.* March 2006. http://www.climatechange.ca.gov/climate_action_team/reports/2006report/2006-04-03_FINAL_CAT_REPORT.PDF). Nonetheless, emissions of other GHGs from the Project (and from almost all GHG emissions sources) would be low relative to emissions of CO_2 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 Project area. For example, the ultimate GHG emissions from the approximately 486 acres of additional commercial uses in the proposed General Plan 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 proposed 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 Project area, the CCAR emissions inventory methodology is not appropriate for estimating GHG emissions from the project.

Additionally, it should also be noted that the emissions described above do not take into account reductions in GHG emissions resulting from implementation of AB 32. Stationary emissions sources on the project site resulting from energy usage and stationary sources that serve the project site's energy needs 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_2 emissions attributable to the Project could be substantially less than current emission 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_2 emissions from the Project would be further reduced. If regulations proposed to comply with AB 1493

survive current legal challenges, by project buildout CO_2 emissions from vehicles associated with the project could be 20% to 30% less than under current conditions.

Impact #3.17-1: Development of the Project could potentially result in a cumulatively considerable incremental contribution to the significant cumulative impact of global climate change

Discussion/Conclusion: As described above in the "Environmental Setting" discussion, 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 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.

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 water supply for the state. Although current forecasts vary (see, e.g., Department of Water Resources [hereafter "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 project area.

When discussing global climate impacts in industrialized nations, such impacts are significantly driven by population / demand (e.g. demand for residential and commercial building arises from society's demand for the additional housing and provider of basic services). Therefore, society's increasing population is the underlying trigger to any greenhouse gas emission associated with housing construction.

In the majority of studies on greenhouse gas emissions, traffic associated with development of residential and commercial buildings due to increasing populations is considered the primary contributor to operational greenhouse gas emissions. Additionally, an increase in stationary source emissions from commercial buildings and residential homes (natural gas use, landscape maintenance equipment, etc.) is anticipated from buildout under the General Plan.

Even if it were assumed that the proposed plan's contribution to global climate change was a significant environmental impact, the impact would be considered unavoidable. Because global climate change is a global issue that can only be addressed through regional, state, national, and international cooperation, plan specific impacts are extremely difficult to determine. Until the SJVAPCD modifies regulations to address the emission of greenhouse gases, specific mitigations that would address climate change locally are speculative. As the SJVAPCD modifies its plans and policies to address global warming considerations, CEQA documents will have to consider those plans and policies when assessing projects. The air quality impact analysis in Section 3.3 and in this section include mitigation measures at the local level to reduce atmospheric greenhouse gas emissions in accordance with existing plans and policies to address global climate change. However; development under the proposed General Plan in combination with growth and development at the regional level, would result in a ***significant, cumulatively considerable and unavoidable*** impact.

Mitigation Measures

Even with the proposed policies and implementation actions in the proposed General Plan, the impact will remain ***significant, cumulatively considerable and unavoidable.*** No mitigation measures are available.

Impact #3.17-2: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Discussion/Conclusion: Implementation of General Plan policies designed to reduce greenhouse gas emissions to the extent practicable will ensure City of Merced General Plan consistency with applicable plans, policies or regulations adopted for the purpose of reducing the emissions of greenhouse gases. This impact is ***less than significant.***

Mitigation Measures

No mitigation measures are required.

Impact #3.17-3: Climate Change could potentially result in an impact on City of Merced water resources

Discussion/Conclusion: From a statewide perspective, global climate change could affect California's environmental resources through potential and uncertain changes related to future air temperatures and precipitation and their resulting impacts on water temperatures, reservoir operations, stream runoff, and sea levels. These changes in hydrological systems could threaten California's economy, public health, and environment. 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. Potential impacts of climate change on water supply and availability could directly and indirectly affect a wide range of institutional, economic, and societal factors. Much uncertainty remains, 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 for 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.

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. 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. 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.

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 (DWR 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 (DWR 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).

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. 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 2,000 years (DWR 2006).

The following topics summarize current literature related to the impact of global climate change on water resources in California's Central Valley:

- **Climate Warming and Water Management Adaptation for California.** Tanaka et al. (2006) explored 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.

- **Potential Implications of PCM Climate Change Scenarios for Sacramento-San Joaquin River Basin Hydrology and Water Resources.** VanRheenen et al. (2004) studied 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) studied climate warming impacts on water availability derived from modeled climate and warming stream flow 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 stream flow 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 stream flow timing in the west, Knowles et al. (2006) addressed 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 degrees Celsius 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 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) considered 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 5.8º 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. The assessment suggests that additional storage could be developed, but with environmental and economic costs.

- **Climate Warming and California's Water Future.** Lund et al. (2003) examined 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; and

- 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 hydrology 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 implementation 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.

As described by the literature survey above, overall, climate change is expected to have a greater effect in Southern California. In the Sacramento Valley/Sierra Nevada area, climate change will have a greater effect on agricultural users than urban users. 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 (DWR 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 reliability of the City of Merced's water supply,(due to the proposed Project's location in Central/Northern California and the reasonable expectation that California's water system can be modified to handle projected climate changes as explained above).

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 the City of Merced water supply and availability in the future. However, based on consideration of the recent regional and local climate change studies described in the literature review above, it is reasonably expected that the impacts of global climate change on the City's water supply would be ***less than significant.***

Mitigation Measures

No mitigation measures are required.

CUMULATIVE IMPACT ANALYSIS

Policies of the proposed General Plan will reduce global climate change impacts; however, buildout under the proposed General Plan will nonetheless result in a substantial amount of GHG emissions contributing to global climate change. Because it cannot be determined to a reasonable degree of certainty that buildout under the proposed General Plan 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 a ***significant, unavoidable and cumulatively considerable*** impact.