Section 4.14
Climate Change

Introduction

This section describes the existing environmental conditions and regulatory setting of the Project area, summarizes the affected environment, and describes environmental effects to the Project, and of the Project, regarding climate change. The effects of and to global climate change were not discussed in the 2001 FEIR and 2001 FEIS.

The Project will not have any direct effects on climate change in the places of use; the effects on climate change, if any, associated with the provision of Project water to the places of use are addressed in Chapter 5, "Cumulative Impacts," and Chapter 6, "Growth-Inducing Impacts."

Summary of Impacts

Table 4.14-1 provides a summary of the potential impacts and mitigation measures for climate change from this Place of Use EIR.

Table 4.14-1. Delta Wetlands Project 2010 Place of Use EIR Impacts and Mitigation Measures for Climate Change

2010 Place of Use EIR Impacts and Mitigation Measures
ALTERNATIVES 1 AND 2
Impact CC-1: Increase in CO_2e Emissions on Project Islands during Construction (LTS) **Mitigation:** No mitigation is required
Impact CC-2: Increase in CO_2e Emissions on Project Islands during Operation (LTS) **Mitigation:** No mitigation is required
ALTERNATIVE 3
Impact CC-1: Increase in CO_2e Emissions on Project Islands during Construction (LTS) **Mitigation:** No mitigation is required
Impact CC-2: Increase in CO_2e Emissions on Project Islands during Operation (LTS) **Mitigation:** No mitigation is required
Note: SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial.

Existing Conditions

This section discusses the existing conditions and regulatory setting.

Sources of Information

Several sources of information were used in developing this report. Three climate change reports prepared for the Project were used (ICF Jones & Stokes 2007, 2008; Horne 2009). In addition, construction and operational activity levels for each alternative were used to estimate greenhouse gas (GHG) emissions.

Regulatory Setting

Executive Order S-3-05

Executive Order S-3-05 was signed by California Governor Schwarzenegger in June 2005. This Executive Order was significant because of its clear declarative statements that climate change poses a threat to the state of California. The Executive Order states that California is “particularly vulnerable” to the impacts of climate change and that climate change has the potential to reduce Sierra snowpack (a primary source of drinking water), exacerbate existing air quality problems, adversely affect human health, threaten coastal real estate and habitat by causing sea level rise, and affect crop production. The Executive Order also states that “mitigation efforts will be necessary to reduce GHG emissions.”

To address the issues described above, the Executive Order established emission reduction targets for the state: reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050. The Secretary of the California Environmental Protection Agency was named as coordinator for this effort, and the Executive Order required a progress report by January 2006 and biannually thereafter. As a result, the California Environmental Protection Agency created the Climate Act Team. The Climate Act Team released the first report, which proposed to meet the emissions targets through voluntary compliance and state incentive and regulatory programs, in March 2006.

Assembly Bill 32

In September 2006, Assembly Bill (AB) 32 was signed by California Governor Schwarzenegger. AB 32 requires that California GHG emissions be reduced to 1990 levels by the year 2020, just like Executive Order S-3-05. However, AB32 is a comprehensive bill that requires the California Air Resources Board (ARB) to adopt regulations requiring the reporting and verification of statewide GHG emissions, and it establishes a schedule of action measures. AB32 also requires that a list of emission-reduction strategies be published to achieve emissions reduction goals. AB 32 requires reductions in California's GHG emissions to 1990 levels by 2020, a roughly 25% reduction under business as usual (BAU) estimates.

Senate Bill 97

Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is an important environmental issue that requires analysis under CEQA. The bill directed the California Office of Planning and Research (OPR) to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, by July 1, 2009. The Resources Agency is required to certify or adopt those guidelines by January 1, 2010. On July 3, 2009, the Resources Agency commenced the Administrative Procedure Act rulemaking process for certifying and adopting these amendments pursuant to Public Resources Code Section 21083.05.

The Natural Resources Agency proposed revisions to the text of the proposed State CEQA Guidelines amendments after a 55-day public comment period and delivered its rulemaking package to the Office of Administrative Law for their review on December 31, 2009. The Office of Administrative Law approved the amendments, and filed them with the Secretary of State for inclusion in the California Code of Regulations on February 16, 2010, and the amendments became effective on March 18, 2010. The guidelines apply retroactively to any incomplete EIR, negative declaration, mitigated negative declaration, or other related document.

The Resources Agency has asked the ARB for assistance in developing CEQA significance thresholds for GHGs. On October 27 and on December 9, 2008, the ARB held public workshops in which they described recommended approaches for setting interim significance thresholds for GHGs under CEQA (California Air Resources Board 2008). Currently, the ARB has not yet finalized the recommended approaches released at their October 27 and December 9, 2008 public workshops.

Actions Taken by the California Office of Planning and Research

In June 2008, the OPR issued a Technical Advisory on CEQA and Climate Change (California Office of Planning and Research 2008). This document recommends that, for projects subject to CEQA, emissions be calculated and mitigation measures be identified to reduce those emissions. The OPR report does not identify emission thresholds for GHGs but instead recommends that each lead agency develop its own thresholds.

Actions Taken by California Attorney General's Office

The California Attorney General (AG) has filed comment letters under CEQA about a number of proposed projects. The AG also has filed several complaints and obtained settlement agreements for CEQA documents covering general plans and individual projects that the AG found either failed to analyze GHG emissions or failed to provide adequate GHG mitigation. The AG's office has prepared a report that lists measures that local agencies should consider under CEQA to offset or reduce global warming impacts. The AG's office also has prepared a chart of modeling tools to estimate GHG emissions impacts of projects and plans. Information on the AG's actions can be found on the California Department of Justice Office of Attorney General web site (California Department of Justice 2009).

California Air Pollution Control Officers Association Guidance

The California Air Pollution Control Officers Association (CAPCOA) released a report in January 2008 that describes methods to estimate and mitigate GHG emissions from projects subject to CEQA. The CAPCOA report evaluates several GHG thresholds that could be used to evaluate the significance of a project's GHG emissions. The CAPCOA report, however, does not recommend any single threshold. Instead, the report is designed as a resource for public agencies as they establish agency procedures for reviewing GHG emissions from projects subject to CEQA (California Air Pollution Officers Association 2008).

Affected Environment

Introduction to Climate Change and Global Warming

The average surface temperature of the Earth has risen by about 1 degree Fahrenheit (°F) in the past century, with most of that occurring during the past two decades (World Meteorological Organization 2005). Correspondingly, the probable increases in average temperatures of between 3 and 8°F (Cayan et al. 2006a) may appear noticeable, but still insignificant. In July, the average high temperature in the region is 94°F. This number is created by averaging temperatures over decades, not just for one particular year. Although the average is 94°F, the individual days and weeks making up that average are as much as 20° warmer or cooler in the extreme cases and up to 10° warmer or cooler on a more regular basis. Therefore, applying an average increase of 8° in a strictly linear way (omitting forcing effects) would mean that the *average* July temperature in the region would be 102°F, and that temperatures could get as hot as 122°F in an extreme event (the current record is 114°F) and could regularly reach 112°F.

The principal GHGs that enter the atmosphere because of human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. From 1750 to 2004, concentrations of CO_2, CH_4, and N_2O have increased globally by 35%, 143%, and 18%, respectively. Other GHGs, such as fluorinated gases, are created and emitted solely through human activities (U.S. Environmental Protection Agency 2008). CO_2 is referenced most frequently when discussing climate change because it is the most commonly emitted gas. However, some less commonly emitted GHGs have a greater climate-forcing effect per molecule.

Global warming potential (GWP) is a measure of how much a given mass of GHGhttp://en.wikipedia.org/wiki/Greenhouse_gas is estimated to contribute to global warming. It is a relative scale that compares the gas in question to that of the same mass of CO_2 (whose GWP is by definition 1). In this analysis, CH_4 is assumed to have a GWP of 21 and N_2O has a GWP of 310 (California Climate Action Registry 2009). Consequently, using each pollutant's GWP, emissions of CO_2, CH_4, and N_2O can be converted into CO_2 equivalence, also denoted as CO_2e.

Greenhouse Gas Pollutants

Carbon Dioxide

CO_2 emissions are associated mainly with combustion of carbon-bearing fossil fuels such as gasoline, diesel, and natural gas used in mobile sources and energy generation–related activities. The EPA estimates that CO_2 emissions accounted for 84.6% of GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The California Energy Commission (CEC) estimates that CO_2 emissions account for 84% of California's anthropogenic (human-made) GHG emissions, nearly all of which is associated with fossil fuel combustion (California Energy Commission 2005). Total CO_2 emissions in the United States increased by 20% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Methane

CH_4 has both natural and anthropogenic sources. The major sources of methane are landfills, natural gas distribution systems, agricultural activities, fireplaces and wood stoves, stationary and mobile fuel combustion, and gas and oil production fields (U.S. Environmental Protection Agency 2008). The EPA estimates that CH_4 emissions accounted for 7.9% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that CH_4 emissions from various sources represent 6.2% of California's total GHG emissions (California Energy Commission 2005). Total CH_4 emissions in the United States decreased by 10% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Nitrous Oxide

N_2O is produced by microbial processes in soil and water, including those reactions that occur in fertilizers that contain nitrogen. The global concentration of N_2O in 1998 was 314 parts per billion (ppb), and in addition to agricultural sources for the gas, some industrial processes (fossil fuel–fired power plants, nylon production, nitric acid production, and vehicle emissions) contribute to its atmospheric load (U.S. Environmental Protection Agency 2008).

The EPA estimates that N_2O emissions accounted for 5.5% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that nitrous oxide emissions from various sources represent 6.6% of California's total GHG emissions (California Energy Commission 2005). Total N_2O emissions in the United States decreased by 2% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Fluorinated Gases (HFCs, PFCs, and SF_6)

Fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6), are powerful GHGs that are emitted from a variety of industrial processes. The primary sources of fluorinated gas emissions in the United States include the HCFC-22 production, electrical transmission and distribution systems, semiconductor manufacturing, aluminum production, and magnesium production and processing. The EPA estimates that fluorinated gas (HFC, PFC, and SF_6) emissions accounted for 2.0% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that fluorinated gas emissions from various sources represent 3.4% of California's total GHG emissions (California Energy Commission 2005). Total fluorinated gas emissions in the United States increased by 58% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Environmental Commitments

The environmental commitments, as described in Chapter 2, would not alter the impact findings related to climate change.

Environmental Effects

Global climate change is a complex phenomenon that is influenced by many environmental factors. There are also many different climate or hydrologic modeling tools available, each with strengths and weaknesses. While changes to the existing climate landscape can be demonstrated by looking at the historical record, it becomes challenging to predict future trends. The process must be simplified to some extent. Climatologists and others who model climate change must make certain assumptions, such as establishing a fixed rate of temperature change, in order to proceed with modeling. Therefore, scientists involved in these modeling efforts do not try to be absolutely predictive, but instead use different model types with different sets of assumptions to capture a range of possible scenarios. It is also necessary to update the model with the latest available data on a regular basis in order to synchronize the models with current conditions. There is no single, certain prediction related to the probability of environmental effects. Scenarios are rated *very likely* if many different models come up with very similar results, and *uncertain* if many different models report very different results. The sections below rely on information from several different published sources and provide a qualitative analysis of potential impacts as they affect North America, California, Contra Costa and San Joaquin Counties, and the places of use.

Temperature Change

Significant increases in the frequency, intensity, and duration of summertime extreme heat days, defined as the 10% warmest days of summer, are projected as a result of climate change (Miller et al. 2007). Temperature change is the driver for climate change, affecting environmental processes that in turn will affect human life. There is strong agreement that many of the most damaging effects of climate change will begin to occur after temperatures increase beyond 3.6°Fahrenheit into the 5.4° and above range. The Intergovernmental Panel on Climate Change (IPCC) Working Group III report determined that reductions in GHG emissions of 50 to 80% would be needed by 2050 in order to stabilize temperature rise at no more than 2°C (Intergovernmental Panel on Climate Change 2007b). The reductions set forth in Executive Order S-3-05 and in AB32 mirror this research.

For California as a whole, the total number of days of extreme heat (summertime temperatures that are substantially hotter and/or more humid than average for location at that time of year) is projected to double relative to the historical mean of 12 days per summer, to an average of 23–24 days per summer by 2034 based on current GHG levels. By 2064, this is projected to increase to 27–39 days.

Various research papers and technical studies have been produced that look specifically at climate impacts in California. One of these is a white paper titled “Climate Scenarios for California,” sponsored by the CEC, which used many of the same assumptions and scenarios as the IPCC reports, but scaled the modeling down to the California level. This paper postulates that the average temperature change from the 1961–1990 historic period to the 2070–2099 future period will be more marked during the summer months than during the winter months (Cayan et al. 2006a).

Higher temperatures would have direct effects on the health of many organisms, including humans. It is probable that rising temperatures would cause an increase in the number of humans who die or become ill as a result of heat waves, change the range (geographically or seasonally) of various infectious disease vectors (such as mosquitoes), and increase cardio-respiratory disease prevalence and mortality associated with ground-level ozone (Intergovernmental Panel on

Climate Change 2007a). Many individual plants also may die or become damaged during heat waves; even if there is ample water in the soil, water loss through the leaves may outpace the ability of the plant to draw water from the soil. Warmer winters would bring some benefits to some parts of California, where cold-related deaths and illnesses during the winter could be reduced (Cayan et al. 2006b). However, the Project area does not typically experience extreme cold under current conditions, leading to the expectation that the stated negative effects would outweigh this positive effect.

Water Supply Changes and Increased Flooding

According to the IPCC 2007 report, the annual mean warming in North America is likely to exceed the global mean warming in most areas, and snow season length and snow depth are very likely to decrease in most of North America (Intergovernmental Panel on Climate Change 2007a). These trends already have been observed, as the snowpack in the Sierra Nevada and the Cascade Range has been declining over the last few decades of record, and the average temperature in California has increased 1°F over the past 50 years (Cayan et al. 2006a). However, while there is high model agreement on warming trends, the agreement among precipitation and hydrologic trend models is not nearly as strong.

The “Climate Scenarios for California” white paper modeled changes in snow water equivalent as of April 1, when the snow season begins to taper off. Snow water equivalent is the amount of water contained within the snowpack. As compared to the 1961–1990 period of record, the net change in snow water equivalent ranges from +6% to -29% (for the 2005–2034 period), from -12% to -42% (for 2035–2064), and from -32% to -79% (for the 2070–2099 period). These results highlight the lack of agreement found among hydrologic models. The ranges of projected change vary widely, and in the near term some modeling even predicts an increase in snow water equivalent. However, in the long term all of the models do agree that snow water equivalent will be reduced, even though further refinement of the modeling will need to be completed to narrow down the range of reductions (Cayan et al. 2006a).

The modeling results indicate that snow losses have the greatest impact in relatively warm low-middle and middle elevations between about 3,280 feet and 6,560 feet (losses of 60% to 93%) and between about 6,560 feet and 9,840 feet (losses of 25% to 79%). The central and northern portions of the Sierra Nevada contain large portions of these low-middle and middle elevations and are subject to the greatest reductions in snow accumulation. (Cayan et al. 2006a.)

The changes in snowmelt described above are not projected because significantly less precipitation is expected to fall, but rather because the snowpack will melt earlier and more precipitation will fall as rain than as snow. If in future conditions more of the precipitation in the watersheds falls as rain than as snow, runoff into the rivers and creeks will increase and the potential for flooding will increase. The effect of climate change on flooding will depend on several factors, including whether storms increase in severity, duration, or frequency. Although strong model agreement has not been reached, it is probable that flooding regimes will alter in the Delta region. Current floodplain locations could expand or contract, changing the number of people in the region that would be affected by flood events, and floods could increase in number, increasing the frequency of negative effects on residents.

The effect of climate change on future demand of water supply remains uncertain (California Department of Water Resources 2006), but changes in water supply are expected and are discussed at greater length in Section 4.1, Water Supply. DWR has sponsored or published a number of papers on the interaction between climate change and water supply and has a Climate Change Portal on the DWR website (www.climatechange.water.ca.gov). Climate change was addressed in the 2009 California Water Plan update. Adaptation (e.g., expanding reservoirs, changing water release schedules, etc.) is expected to play a key role in addressing the effects of climate change on water supply.

Reduction in Surface Water Quality

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 snowmelt, and/or shifts 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, although there may be more flood events, the overall streamflow decrease from a lack of summer snowpack potentially could 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 Delta and coastal regions (Kiparsky and Gleick 2003). Still, considerable work remains to determine the potential effect of global climate change on water quality.

Effects to Fisheries and Aquatic Resources

The health of river ecosystems is heavily dependent on water temperatures and streamflows. The IPCC Working Group II report recites a litany of temperature and flow effects on fisheries that already have been observed: the sea-run salmon stocks are in steep decline throughout much of North America (Gallagher and Wood 2003), Pacific salmon have been appearing in Arctic rivers (Babaluk et al. 2000), and salmonid species have been affected by warming in U.S. streams (O'Neal 2002). It is probable that increases in average temperatures in the state would cause corresponding increases in water temperatures. Rates of fish-egg development and mortality increase with temperature rise within species-specific tolerance ranges (Kamler 2002). Many fish species migrate into Delta waterways during specific seasons to breed, and these fish rely on late-fall and early winter flows in order to complete the migration. If increased flows are delayed, possibly as a result of lessened groundwater recharge or shifts in the onset of the rainy season, this would be a barrier to migration. These potential effects could further endanger the sustainability of aquatic populations that are already listed under the federal or California ESA or could cause non-listed species to require listing.

Increased Rate of Sea Level Rise

As global temperatures rise due to climate change, the increased temperatures are anticipated to accelerate the rate at which sea levels rise. The IPCC Working Group I report contains a thorough discussion of the current understanding of sea level rise and climate change. While there is strong model agreement that sea levels will continue to rise and that the rate of rise will increase, the ultimate amount of rise is uncertain (Intergovernmental Panel on Climate Change 2007a). A white paper entitled “Projecting Future Sea Level,” published by the California Climate Change Center, estimated a sea level rise from 4 to 35 inches every century (0.3 to 2.9 feet), depending on the model and assumptions used (Cayan et al. 2006b).

The Delta region is hydrologically connected to San Francisco Bay and will be directly influenced by sea level rise. Among the more critical potential effects of sea level rise in the Delta are threats to flood protection and increased salinity in the Delta (Kiparsky and Gleick 2003). In recognition of this concern, California passed a bond measure intended to finance the process of stabilizing and improving California’s levee systems. DWR also is continuing to study the issue to determine what other system improvements may be necessary to adapt to changes in water surface elevations.

Water for the SWP and the federal CVP is taken from the south Delta. If salt water from San Francisco Bay backs upward through the Delta system, freshwater supplies could be degraded. There are potential solutions to this problem, should it occur, that continue to be examined by DWR. A purification process could be implemented, but extracting salt from water tends to be costly. A peripheral canal that would bypass the Delta is another option that was originally suggested in the early 1980s but remains highly controversial.

Rapid 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 (California Department of Water Resources 2006). California is expected to be able to adapt to the water supply challenges posed by climate change, even under some of the warmer and dryer projections for change. Sudden and unexpected changes in climate, however, could leave many of the agencies responsible for management of vulnerable sectors (water supply, levees, health, etc.) unprepared and in extreme situations would have significant implications for California and the health and safety of its residents. For example, there is speculation that some of the recent droughts that occurred in California and the western United States could have been attributable, 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 (California Department of Water Resources 2006).

Impacts and Mitigation Measures

The following section first evaluates the potential impacts of global climate change on the Project, then the potential impacts of the Project on climate change.

Potential Effects of Climate Change on the Project

As mentioned above, potential effects of climate change include:

- temperature change,
- water supply changes and increased flooding,
- reduction of surface water quality,
- effects to fisheries and aquatic resources,
- increased rate of sea level rise, and
- rapid climate change.

Although many of these changes are speculative, they do represent possible effects of climate change that would require adaptation. The Project would enable California to adapt to increases in temperatures and resulting shortages in water supply by providing additional water storage. Increased diversion capacity resulting from implementation of the Project would help to accommodate increased winter runoff scenarios resulting from climate change. In addition, added storage allows for flexibility between the timing of diversion and timing of use, which is necessary due to limited pumping opportunities.

Of these potential impacts, sea level increases have the potential to cause the largest impact on the Project. If sea level increases dramatically, it could require the Project levees to be raised periodically to withstand the higher sea levels. Refer to Section 4.3, Flood Control and Levee Stability, for a discussion of levee design elements that address anticipated sea level rise.

Potential Impacts of the Project on Climate Change

Significance Criteria

The climate change impact analysis considered several criteria for determining the significance of impacts related to this issue. The analysis took into account both relevant criteria contained in Appendix G of the State CEQA Guidelines

(Association of Environmental Professionals 2009) and Project-specific criteria developed by the lead agency to address potential impacts unique to the Project's location and elements.

As previously discussed, the State CEQA Guidelines were amended to address greenhouse gas emissions. The State CEQA Guidelines, as amended in 2010, require lead agencies to analyze a project's GHG emissions. The guidelines confirm the discretion of lead agencies to determine appropriate significance thresholds but require the preparation of an EIR if "there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with adopted regulations or requirements" (§15064.4). With regards to establishing significance criteria for the determination of significance of greenhouse gas emissions, lead agencies are given discretion to perform either a quantitative or a qualitative analysis in determining the significance of a project's greenhouse gas emissions, although the lead agency must base its analysis "to the extent possible on scientific and factual data." (§15064.4) In addition, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence (§15064.7).

For most projects, there is no clear or established method to determine whether a particular project will negatively affect the ability of the state to meet emissions goals. At the time of this writing, a host of white papers on the subject has been published, and many conferences and workshops are being held each month. While all conclude that actions must be taken, the subject of significance criteria is a matter of great debate.

The Bay Area Air Quality Management District (BAAQMD) has not yet established significance criteria for GHGs, although it recently has begun a process to revise and update significance criteria and has issued their draft CEQA guidance for public comment and review. These revisions will include a significance threshold for GHGs (Tholen pers. comm.). Although it is clear that emissions throughout the state must be reduced in order to meet reduction targets, the San Joaquin Valley Air Pollution Control District (SJVAPCD) is the only air district in California that has identified a significance threshold for GHG emissions. In December 2009, the SJVAPCD formally adopted the region's first GHG thresholds for determining significant climate change impacts in the SJVAPCD. The guidance is intended to streamline CEQA review by pre-quantifying emissions reductions that would be achieved through the implementation of Best Performance Standards (BPS). BPS are developed by the SJVAPCD and are based on current technologies, operating principles, and energy efficiency tactics. According to the December 2009 report, stationary source projects failing to implement BPS or demonstrate a 29% reduction in GHG emissions relative to BAU conditions are considered to have a significant impact on climate change. The GHG thresholds apply only to stationary source projects that would result in increased GHG emissions, of which the SJVAPCD is the lead agency. (San Joaquin Valley Air Pollution Control District 2009.) The new SJVAPCD guidance is not applicable to the Proposed Project.

Greenhouse Gas Emissions Estimation Methods

The approach used to evaluate each alternative's GHG impacts involved estimating GHG emissions for construction, existing conditions, the future No-Project Alternative, and Alternatives 1 and 3. Alternative 2's GHG emissions were assumed equal to Alternative 1.

Table 4.14-2 summarizes existing GHG emissions on the Project islands. Emissions are shown for three primary sources; peat soil oxidation represents the largest GHG emissions source, following by farming and recreation activities Recreation activities include vehicle trips associated with hunting and boating activities, as well as boating emissions.

Existing and future no-project GHG emissions are generated by three primary sources: peat oxidation, farming, and recreation. Peat oxidation emissions involve oxidation of peat soil organic matter that produces CO_2 and methane. Exposed peat soils are oxidized continuously when not moist. The agricultural oxidation rate would be reduced by almost 90% if converted to reservoirs or wetlands (ICF Jones & Stokes 2007, 2008).

Farming emissions are based on existing estimates of farming activity and associated gasoline and diesel fuel use. Recreation emissions are based on the number of vehicle trips associated with various recreational uses.

Table 4.14-2. Existing Greenhouse Gas Emissions

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	231,737	255,374	–	–
Farming	2,267	2,488	0.5	–
Recreation	18	20	–	–
Total	234,021	257,882	0.5	–

Notes: Estimates of peat oxidation based on emission factors included in ICF Jones & Stokes reports (2007 and 2008) and assume 15,022 acres with emissions of 17 tons CO_2 per acre per year. Farming and recreation emissions based on activity levels as specified in Appendix C, Table C-3.

Proposed Project (Alternative 2)

Impact CC-1: Increase in CO_2e Emissions on Project Islands during Construction

Table 4.14-3 shows construction emissions for Alternatives 1, 2, and 3. Alternative 2 would generate approximately 2,313 metric tons of CO_2e per year for construction. Impacts associated with GHGs are long-term climatic changes, which are beyond the regulatory purview of the individual air districts. GHGs tend to accumulate in the atmosphere because of their relatively long lifespan. As a result, their impact on the atmosphere is mostly independent of the point of emission; GHG emissions are more appropriately evaluated on a regional, state, or even national scale than on an individual project level. Impacts related to climate change are considered less than significant, as climate change would not occur with Project implementation.

Table 4.14-3. Construction Emissions for Alternatives 1, 2, and 3

Alternative	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Alternatives 1 and 2	2,313	2,339	0.3	0.7
Alternative 3	4,020	4,112	0.5	1.0

Notes: Construction emissions based on activity levels as specified in Appendix C, Tables C-5 and C-6.

Mitigation
No mitigation required.

Impact CC-2: Increase in CO_2e Emissions on Project Islands during Operation

Table 4.14-4 shows Alternative 2 GHG emissions assuming electricity is used to pump water onto and off of the islands. Table 4.14-5 shows Alternative 2 GHG emissions assuming diesel-fueled pumps are used instead of electrically powered pumps. For both scenarios, peat oxidation constitutes the largest percentage of emissions, followed by recreation emissions, methane flux, and pumping. Methane flux estimates are based on a white paper prepared specifically for the Project (Horne 2009). Methane flux emissions are produced primarily from the reduction of CO_2 under anaerobic conditions. Alternative 2 would generate 141,876 metric tons CO_2e per year. However, compared to existing conditions, Alternative 2 would reduce emissions by 92,145 metric tons CO_2e. Compared to No-Project Conditions, Alternative 2 would reduce emissions by 99,335 metric tons CO_2e. This is a beneficial and less than significant impact, and no mitigation is required.

As shown in Table 4.14-5, if diesel fuel is used to power the water pumps, the net GHG benefit would be reduced slightly compared to using electrically powered pumps. However, there still would be a substantial GHG benefit under the diesel powered–pump scenario. This benefit is attributable primarily to the reduction in peat oxidation GHG emissions.

Table 4.14-4. Alternative 2 Greenhouse Gas Emissions with Electricity Used for Pumping

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	125,825	138,659	–	–
Farming	2,214	2,436	0.2	–
Recreation	9,739	10,058	3.7	1.9
Pumping	1,097	1,207	0.0	0.0
Methane flux	3,001	–	157.5	–
Total	141,876	152,361	161	2
Net change from existing	(92,145)	(105,521)	161	2
Net change from Future No-Project	(99,335)	(113,163)	160	1

Notes: Estimates of peat oxidation based on ICF Jones & Stokes reports (2007 and 2008). Farming, recreation, and pumping emissions based on activity levels as specified in Appendix C, Table C-5. Methane flux based on report by Alex Horne, Ph.D. (2009). Assumes electricity used to pump water. GHG emissions associated with electricity used for pumping based on emission factors provided by the California Climate Action Registry (2009). Alternatives 1 and 2 assume 3 million kilowatt-hours per year required to pump water. Alternative 3 assumes 6 million kilowatt-hours per year required for pumping. On-road vehicle trip emissions estimated with URBEMIS2007, version 9.2.4. Agricultural emissions estimated with OFFROAD2007.

Table 4.14-5. Alternative 2 Greenhouse Gas Emissions with Diesel Fuel Used for Pumping

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	125,825	138,659	–	–
Farming	2,214	2,436	0.2	–
Recreation	9,739	10,058	3.7	1.9
Pumping	1,549	1,697	0.2	0.0
Methane flux	3,001	–	157.5	–
Total	142,328	152,851	161.6	1.9
Net change from existing	(91,693)	(105,031)	161.1	1.9
Net change from Future No-Project	(98,883)	(112,673)	160.4	1.1

Notes: Estimates of peat oxidation based on ICF Jones & Stokes report (2007 and 2008). Farming, recreation, and pumping emissions based on activity levels as specified in Appendix C, Table C-5. Methane flux based on report by Alex Horne, Ph.D. (2009). Assumes diesel fuel used to pump water. GHG emissions associated with diesel fuel used for pumping based on emission factors provided by the California Climate Action Registry (2009). Alternatives 1 and 2 assume 3 million kilowatt-hours per year required to pump water. Alternative 3 assumes 6 million kilowatt-hours per year required for pumping. On-road vehicle trip emissions estimated with URBEMIS2007, version 9.2.4. Agricultural emissions estimated with OFFROAD2007.

Mitigation

No mitigation required.

Alternative 1

Under Alternative 1, GHG emissions and associated impacts would be similar to those discussed under Alternative 2.

Alternative 3

Impact CC-1: Increase in CO_2e Emissions on Project Islands during Construction

Table 4.14-3 shows construction emissions for Alternatives 1, 2, and 3. Alternative 3 would generate approximately 4,020 metric tons of CO_2e per year for construction. As previously discussed, GHG emissions are more appropriately evaluated on a regional, state, or even national scale than on an individual project level. Impacts related to climate change are considered less than significant, as climate change would not occur with Project implementation..

Mitigation
No mitigation required.

Impact CC-2: Increase in CO_2e Emissions on Project Islands during Operation

Table 4.14-6 shows Alternative 3 GHG emissions assuming electricity is used to pump water onto and off of the islands. Table 4.14-7 shows Alternative 3 GHG emissions assume diesel-fueled pumps are used instead of electrically powered pumps. For both scenarios, peat oxidation constitutes the largest percentage of emissions, followed by recreation emissions, methane flux, and pumping. Methane flux estimates are based on a white paper prepared specifically for the Project (Horne 2009). Methane flux emissions are produced primarily from the reduction of CO_2 under anaerobic conditions. Alternative 3 would generate 45,338 metric tons of CO_2e per year, assuming electrically powered pumps (Table 4.14-5). However, compared to existing conditions, Alternative 3 would reduce emissions by 188,683 metric tons CO_2e. Compared to No-Project Conditions, Alternative 3 would reduce emissions by 195,873 metric tons CO_2e. This is a beneficial and less-than-significant impact, and no mitigation is required.

As shown in Table 4.14-7, if diesel fuel is used to power the water pumps, the net GHG benefit would be reduced slightly as compared to using electrically powered pumps. However, there still would be a substantial GHG benefit under the diesel powered–pump scenario. This benefit, though, is attributable primarily to the reduction in peat oxidation GHG emissions.

Table 4.14-6. Alternative 3 Greenhouse Gas Emissions with Electricity Used for Pumping

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	27,263	30,044	–	–
Farming	–	–	–	–
Recreation	10,254	10,590	3.9	2.0
Pumping	2,194	2,414	0.0	0.0
Methane flux	5,628	–	295.3	–
Total	45,338	43,048	299	2
Net change from existing	(188,683)	(214,834)	298.8	2.0
Net change from Future No-Project	(195,873)	(222,476)	298.0	1.2

Notes: Estimates of peat oxidation based on ICF Jones & Stokes reports (2007 and 2008). Farming, recreation, and pumping emissions based on activity levels as specified in Appendix C, Table C-5. Methane flux based on report by Alex Horne, Ph.D. (2009). Assumes electricity used to pump water. GHG emissions associated with electricity used to pump water based on emission factors provided by the California Climate Action Registry (2009). Alternative 3 assumes 6 million kilowatt-hours per year required for pumping. On-road vehicle trip emissions estimated with URBEMIS2007, version 9.2.4. Agricultural emissions estimated with OFFROAD2007.

Table 4.14-7. Alternative 3 Greenhouse Gas Emissions with Diesel Fuel Used for Pumping

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	27,263	30,044	–	–
Farming	–	–	–	–
Recreation	10,254	10,590	3.9	2.0
Pumping	2,324	2,546	0.4	0.0
Methane flux	5,628	–	295.3	–
Total	45,468	43,180	299.5	2.1
Net change from existing	(188,553)	(214,702)	299.1	2.1
Net change from Future No-Project	(195,743)	(222,344)	298.3	1.2

Notes: Estimates of peat oxidation based on ICF Jones & Stokes reports (2007 and 2008). Farming, recreation, and pumping emissions based on activity levels as specified in Appendix C, Table C-6. Methane flux based on report by Alex Horne, Ph.D. (2009). Assumes diesel fuel used to pump water. GHG emissions associated with diesel fuel used to pump water based on emission factors provided by the California Climate Action Registry (2009). On-road vehicle trip emissions estimated with URBEMIS2007, version 9.2.4. Agricultural emissions estimated with OFFROAD2007.

Mitigation

No mitigation required.

No-Project Alternative

Table 4.14-8 shows future (2020) no-project GHG emissions for the Project islands. Since the No-Project Alternative would not involve any construction, only operational GHG emissions are discussed in this section. The No-Project Alternative is similar to existing conditions in that peat oxidation represents the largest source of emissions, followed by farming and recreation. As compared to existing conditions, peat oxidation emissions would remain relatively unchanged, while farming and recreational activity and emissions would increase.

Table 4.14-8. Future No-Project Greenhouse Gas Emissions

Emission Source	CO_2e (metric tons/yr)	CO_2 (tons/yr)	CH_4 (tons/yr)	N_2O (tons/yr)
Peat oxidation	231,737	255,374	–	–
Farming	9,357	10,020	1.2	0.9
Recreation	117	129	–	–
Total	241,211	265,523	1.2	0.9
Net change from existing	7,190	7,642	0.8	0.9

Notes: Estimates of peat oxidation based on emission factors included in ICF Jones & Stokes reports (2007 and 2008) and assume 15,022 acres with emissions of 17 tons CO_2 per acre per year. Farming and recreation emissions based on activity levels as specified in Appendix C, Table C-4.