- **Board of Directors**
  Water Planning, Quality and Resources Committee

September 12, 2006 Board Meeting

9-4

Subject

Review of DWR's Report regarding "Progress on Incorporating Climate Change into Management of California's Water Resources"

Description

Overview. In July, the Department of Water Resources released a report entitled "Progress on Incorporating Climate Change into Management of California's Water Resources." DWR's report is a response to Executive Order S-3-05 issued by Governor Arnold Schwarzenegger in June 2005. The Executive Order requires biennial reports on global warming impacts to California, including impacts to water supply, public health, agriculture, the coastline and forestry resources, along with mitigation and adaptation plans to combat the impacts. Staff reviewed DWR's report and provides the following report to summarize the highlights.

The purpose of the report is to demonstrate how existing DWR analytical tools can be used to incorporate climate change science into California water resources management. Different sections of the report discuss potential changes to California's climate and hydrology, as well as impacts to water supply, water quality, flood control, and agricultural water use. The report also reviews existing evidence of climate change impacts in California's hydrologic record.

DWR emphasizes that the results from this report are "an example of impacts assessment" and are not a "risk assessment." Impact assessments characterize how systems may react to a given change and help to "inform managers of potential future issues that may require management action." Risk assessments attach probabilities to the outcomes, so their likelihoods can be characterized. DWR's report acknowledges that water managers need to understand the likelihood or probability of certain outcomes in order to make informed decisions. The results in the report are described as preliminary and "not sufficient by themselves to make policy decisions."

Report Assumptions. DWR uses four climate change scenarios in the report, derived from two General Circulation Models (GCMs) combined with two United Nations International Panel on Climate Change future green house gas emissions levels. The four scenarios range from relatively strong warming and modest drying, to weak warming and weak precipitation increase. In order to assess regional impacts, the scenarios from the GCMs are "downscaled" to a finer resolution using a statistical methodology.

The report provides an overview of the hydrological consequences of climate change, some of which have been presented in prior board workshops. These include:

- Reductions in snow pack
- Changes in the timing and amount of runoff
- Changes in the frequency and magnitude of extreme events
- Changes in vegetation distribution and wildfire occurrence
- Changes in sea level rise in the Delta and implications for groundwater aquifers
- Increases in water temperatures
- Changes in future agricultural and urban water demand
- Impacts to fisheries

All of these impacts have implications for managing California's interconnected water management system. In assessing the impacts of climate change on SWP and CVP supplies, DWR's report does not consider changes in

demands, sea level rise, changing weather variability, or operational and infrastructure changes. These factors are beyond the scope of DWR's current study, but will be addressed in future reports.

Water Supply Impacts. DWR used projected year 2050 climate conditions overlaid on projected 2020 land use development to assess the potential impacts to water supply. Based on the four climate scenarios, average SWP Table A deliveries range from up to 10 percent lower to 1.2 percent higher than DWR's base case scenario. For the worst two-year hydrology (1976-77), Table A deliveries range from 13 percent to 45 percent lower than the base case. In three of the four scenarios, carryover storage is lower than the base case. Average Article 21 supplies (unregulated and unscheduled supplies) increase from two to seven percent over the base case for three of the four scenarios. In the mildly wetter case, the capture of winter runoff decreases slightly due to increased flood control operations in the main SWP and CVP reservoirs. In all scenarios, winter exports are limited by Banks capacity and south of Delta conveyance. In the three scenarios with drier conditions, power load decreases due to lower deliveries; while in the slightly wetter scenario, the power load increases due to slightly higher deliveries. In-stream temperatures increase in all four scenarios.

Compared to Metropolitan's current SWP assumptions, average Table A deliveries are lower in three of the four scenarios. The results generally show lower deliveries for wet and normal years. However, for 1977 (the worst-case hydrology) Metropolitan assumes lower SWP deliveries than all four of the climate change scenarios.

Delta Water Quality Impacts. Based on the four scenarios used in DWR's analysis, impacts to the Delta's water quality are relatively minor. No significant operational changes would be needed to comply with the 250 mg/L chloride standards, and there would be a slight reduction in compliance with the 150 mg/L chloride standard in two of the scenarios. These results do not account for the impact of sea level rise, which would be expected to increase salt intrusion and could reduce DWR's ability to meet the 150 mg/L chloride standard in dry years. Additionally, rising sea levels would increase the frequency of levee overtopping and failure, adversely affecting salinity levels in the Delta.

Flood Management. According to the report, statewide historical trends show a slight increase in runoff over the last 30 years, and variability in precipitation and runoff seems to be increasing. However, at this point in time DWR is not able to analyze changes to flooding due to modeling limitations.

Agricultural Water Demand. DWR investigated climate change impacts to evapotranspiration in order to assess the potential effects on statewide demand for irrigation water. Their analysis found that a three degree Celsius temperature increase would translate into a three to six percent net increase in evapotranspiration. While this seems like a minor change, it could cause a significant increase in agricultural water demand. However, there are still many factors not accounted for in DWR's analysis, including localized climate variability, the effects of clouds and pollution on solar radiation, urbanization of agricultural lands, changes in water use efficiency, and how agricultural crops respond to increased carbon dioxide.

DWR's Next Steps. The report is a snapshot of DWR's ability to model climate change impacts within their modeling framework. Moving forward, the report describes several areas of research DWR will focus on, including:

- Producing probabilistic climate change scenarios and risk assessments
- Improving analysis of sea level rise impacts on the Delta
- Studying different SWP and CVP operational scenarios
- Quantifying climate change impacts on flood management operations
- Refining evapotranspiration models for studying impacts to agricultural water use
- Integrating DWR's modeling and analysis tools
- Supporting the California Energy Commission in their coordination of state research activities
- Evaluating more climate change scenarios

DWR plans to continue research in these areas and ultimately hopes to provide ranges of impacts and associated likelihoods in order to "aid decision makers in planning appropriate response strategies." These goals are generally consistent with Metropolitan's adopted board policies. Staff will provide further reports to the Board as additional information and analyses become available.

Policy

By Minute Item 44813, dated March 12, 2002, the Board adopted the proposed policy principles regarding global climate change and water resources, as set forth in the letter signed by the Chief Executive Officer on February 27, 2002.

Fiscal Impact

None

8/24/2006
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8/25/2006
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