



## INFORMATION ITEM

Discussion of Selected Key Draft Findings from the Delta Adapts Vulnerability Assessment

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**SUMMARY:** Delta Adapts: Creating a Climate Resilient Future (Delta Adapts) is the Council's climate change study consisting of a first-ever climate change vulnerability assessment and adaptation strategy for the Delta and Suisun Marsh. Council staff will present an update on Delta Adapts and selected draft findings regarding implications for equity, water supply, flooding, and ecosystem.

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### BACKGROUND

The Delta Reform Act (DRA) specifies consideration of "the future impact of climate change and sea level rise" in restoration planning (Water Code [Wat. Code] section 85066) and identifies a restoration timeline horizon of the year 2100 (Wat. Code section 85302). The DRA also notes that the Delta Plan may address "the effects of climate change and sea level rise on the three state highways that cross the Delta" (Wat. Code section 85307). Executive Order B-30-15, signed by Governor Brown in April 2015, requires that State agencies incorporate climate change into planning and investment decisions and requires State agencies to prioritize natural infrastructure and actions for climate preparedness and protection of the most vulnerable populations.

Climate change is already altering the physical environment of the Delta. Over the long term, climate change in the Delta is expected to adversely affect human health and safety, lead to economic disruptions, diminish water supply, degrade water quality, shift ecosystem function and habitat qualities, and increase the challenges of providing basic services. Many of these impacts will disproportionately affect disadvantaged communities. Delta Adapts will help the Council assess specific climate risks and vulnerabilities in the Delta and, in coordination with a diverse group of stakeholders, develop adaptation strategies to address those vulnerabilities. The Council did endorse a set of Climate Change Resilience Goals (resilience goals) in early 2019 to provide a long view toward Delta regional values and priorities. The resilience goals were used by the project team to focus Delta Adapts' methods and recommendations.

Delta Adapts consists of two phases: 1) a **vulnerability assessment** to improve understanding of regional vulnerabilities due to climate change in order to protect the vital resources the Delta provides to California and beyond with a focus on

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State interests and investments, followed by 2) an **adaptation strategy** detailing strategies and tools that State, regional, and local governments can use to help communities, infrastructure, and ecosystems thrive in the face of climate change. The vulnerability assessment analyzes the vulnerability of various asset sectors to several climate stressors and hazards. Climate stressors analyzed include sea level rise, precipitation and runoff patterns, and air temperature changes. Climate hazards assessed include flooding, extreme heat, drought, and wildfire smoke. Asset sectors addressed include:

- Residents
- Agriculture
- Key community facilities and services
- Flood control infrastructure
- Parks and recreation
- Transportation
- Water supply
- Ecosystems

### **DELTA ADAPTS APPROACH**

Delta Adapts is a regional, planning-level study prepared to inform policy. Delta Adapts draws on the best available science and uses state guidance, including the Adaptation Planning Guide, Safeguarding California Plan: 2018 Update (California's Climate Adaptation Strategy), sea level rise planning guidance from the Ocean Protection Council, the Bay Conservation and Development Commission's Adapting to Rising Tides project, and guidance on defining vulnerable communities from the Governor's Office of Planning and Research.

### **DELTA ADAPTS GOALS**

The Delta Adapts study has an overarching goal of building climate resilience in the Delta and several specific goals:

- Inform future work at the Council;
- Provide local governments with a toolkit of information to incorporate into their regulatory and planning documents;
- Integrate climate change into the state's prioritization of future Delta actions and investments; and
- Serve as a framework to be built upon by the Council and others in years to come.

## **OUTREACH AND ENGAGEMENT**

To promote information exchange between diverse Delta stakeholders, the Council established a **Stakeholder Work Group** (SWG) with members from local and regional government agencies, State agencies, utility companies, water districts, and environmental organizations. SWG members reflect the broad range of stakeholder interests in the Delta. The SWG met on October 2, 2019, to provide input on key assets to be considered in the analysis. The SWG will meet two or three more times throughout the Delta Adapts initiative. The next meeting is anticipated to take place in December 2020.

A **Technical Advisory Committee** (TAC) provides expert knowledge, peer-review, and guidance throughout the development of Delta Adapts. The TAC is comprised of experts from public agencies, academic institutions, non-profit organizations, the private sector, and individuals with particular knowledge of climate change, the Delta, and its resources. The TAC has met both as a larger group and in smaller group briefings on particular technical subjects. A list of the TAC members can be found on the Delta Adapts webpage, <https://deltacouncil.ca.gov/delta-plan/climate-change>.

In addition to convening the SWG and TAC, Council staff have provided briefings to various agencies and working groups throughout the development of Delta Adapts, including the Department of Water Resources (DWR), California Natural Resources Agency, and the Delta Levees and Habitat Advisory Committee, among others. Council staff has also presented on Delta Adapts at various regional events. Particular focus has been given to briefing local governments and flood control agencies on the draft flood maps, in order to ground-truth the data and analysis and seek recommendations for improvements. Staff has also conducted outreach with community-based organizations (CBOs) that represent and provide services to vulnerable communities in the Delta region. Council staff have reached out to over 40 CBOs and consulted with 16 of these organizations to establish relationships and receive input on Delta Adapts toward a goal that the Delta Adapts engagement approach is equitable and inclusive.

## **KEY FINDINGS FROM TECHNICAL ANALYSES**

Council staff prepared several technical reports that inform the vulnerability assessment. The technical analyses cover equity, flood hazards, water supply, and Delta ecosystems.

## **EQUITY ANALYSIS RESULTS**

Climate change impacts will disproportionately affect vulnerable communities, including those located within the Delta. The Council developed a method for assessing the location and scale of this impact. The analysis includes a literature review to identify factors that increase vulnerability to flooding, extreme heat, and wildfire – whether by increasing the likelihood of exposure, increasing sensitivity to the hazard, or reducing the capacity to adapt or respond. There were many commonalities across the three climate hazards. For example, preexisting health conditions such as asthma, diabetes, or cardiovascular disease increase sensitivity to all three hazards.

Council staff then developed a social vulnerability index using 14 socioeconomic and health indicators based on the factors that increase vulnerability. The presence of multiple, intersecting indicators suggests that a community is more vulnerable to climate change. Communities that scored in the 70<sup>th</sup> percentile for at least four indicators are categorized as highly vulnerable, while those with more than half of the indicators in the 70<sup>th</sup> percentile are categorized as having the highest social vulnerability. **Attachment 1** shows social vulnerability in the Delta.

Results indicate that the communities with the highest sensitivity and lowest adaptive capacity to climate change impacts are in the cities of West Sacramento, Antioch, Pittsburg, Stockton, and much of the southern Delta. The factors that make these communities vulnerable vary from place to place. For example, in one of the most vulnerable communities in Stockton, 78 percent of households have income below the poverty line, 47 percent of households lack access to a vehicle, and 37 percent of residents lack health insurance. In a highly vulnerable community in Pittsburg, 42 percent of households have at least one member with a disability, and the incidence of asthma, heart attacks, and low birth weight infants are in the 70<sup>th</sup> percentile.

## **WATER SUPPLY ANALYSIS KEY FINDINGS**

Rivers flowing into the Delta provide water supplies to nearly 30 million Californians and hundreds of thousands of acres of farmland throughout the Delta and Central Valley. Climate change will increase sea levels and fundamentally change the amount and timing of river flows into the Delta. Both will challenge water supply operations and reduce the reliability of Delta water supplies. The Delta Adapts water supply analysis builds on and expands analysis conducted by DWR and the University of Massachusetts (published in *Climatic Change*). The analysis shows that higher temperatures, out of all the climate impacts analyzed, pose the greatest risk to Delta water supply. Higher temperatures alone will likely diminish Delta exports by 350,000 to 500,000 acre-feet per year by 2050 (about 6 to 9 percent of average

annual historic Delta exports). Higher interannual precipitation variability will especially affect water supply in dry years. Sea level rise will have a nominal effect on water supply through mid-century.

Results show that average annual Delta exports decline in all year types, with declines most significant in below-average years. Years in which there is not enough water to meet all minimum water quality and environmental flow requirements will remain rare, but they will be more severe when they occur, causing wider and deeper impacts. Lower north-of-Delta carryover storage conditions will exacerbate the vulnerability of the system to increased precipitation variability. Finally, droughts will become more frequent and severe.

### **FLOOD ANALYSIS KEY FINDINGS**

As with water supply, changing Delta inflow (particularly during storms) and rising sea levels will increase water levels throughout the Delta, increasing the risks of flooding on Delta islands and low lying areas along the periphery of the Delta. Delta Adapts models levee overtopping and subsequent inundation, incorporating sea level rise and riverine inflow changes due to climate change. It is important to note that the model looked at flooding due to levee overtopping, but not due to levee failure (the Delta Levee Investment Strategy evaluates the risks of levee failures below overtopping). The flood analysis produced two kinds of flood maps: *deterministic* and *probabilistic* maps. The deterministic maps show flooding under a specific set of conditions, while the probabilistic maps show the probability of flooding (across a range of flood events) in each area. **Table 1** shows the deterministic scenario maps, and **Table 2** shows the probabilistic scenario maps. **Attachment 2** includes all flood maps.

By 2050, about 35 percent of the Delta would be exposed to flooding during a 100-year event (which has a 1 percent chance of occurring in any year). All of the flood-exposed areas are in the central and south Delta. About half of this area would be exposed to flooding at well below the 100-year event, with many areas flooding during a decadal storm—a level of flooding that would likely be too-high risk to justify continued agricultural investment. Furthermore, several urbanized and urbanizing areas will be exposed to flooding, with about 10 percent of the Delta's population (approximately 65,000 people) living on islands exposed to flooding during a 100-year event, increasing the potential for significant economic disruption and loss. More than 11,000 of these exposed residents live in communities with the highest social vulnerability to climate change.

By 2085, most of the south and central Delta will experience a greater than 65 percent chance of flooding over a ten-year period, and 20 percent of the Delta’s population (approximately 120,000 people) would be exposed to flooding during a 100-year event. More than 20,000 of these exposed residents live in communities with the highest social vulnerability to climate change. During a 200-year event, 44 percent of the Delta’s population would be exposed to flooding, with most of the additional population in North Stockton and Sacramento’s Pocket area. Areas of the Delta north of Locke will continue to have relatively low chances of flooding even under 2085 conditions, highlighting the value provided by previous flood management investments along the Sacramento and American rivers and, most importantly, the Yolo Bypass.

**Table 1. Deterministic Scenarios for Flood Hazard Analysis and Mapping**

<b>Mapping Scenario</b>	<b>Planning Horizon</b>	<b>Sea Level Rise</b>	<b>Watershed Hydrology</b>	<b>Storm Event</b>
0	Existing	0”	Historical	100-year water level
1	2030	6”	Historical	100-year water level
2	2050	12”	Mid-century (2035-2064) RCP 8.5	100-year water level
3	2050	24”	Mid-century (2035-2064) RCP 8.5	100-year water level
4	2050+	42”	End-of-century (2070-2099) RCP 8.5	100-year water level

**Table 2. Summary of Probabilistic Scenarios for Flood Hazard Mapping**

<b>Mapping Scenario</b>	<b>Planning Horizon</b>	<b>Sea Level Rise Distribution</b>	<b>Watershed Hydrology (TDI Distribution)</b>
5	2030	RCP 8.5 2030	Historical
6	2050	RCP 8.5 2050	Mid-Century (2035-2064) RCP 8.5
7	2085	RCP 8.5 2085	End-of-Century (2070-2099) RCP 8.5

**ECOSYSTEM ANALYSIS KEY FINDINGS**

Protecting and restoring the Delta ecosystem is one of the Delta Plan’s coequal goals. Since the 1800’s, ecosystems in the Delta have been heavily impacted by development, with over 98% of freshwater tidal wetlands lost and aquatic ecosystems completely transformed. Climate change poses a substantial threat to the Delta’s critical remaining ecosystems. The Ecosystem analysis looked at the vulnerability of ecosystems to predicted changes in local temperature, precipitation, and sea level rise. Ecosystems like the Delta that are highly disturbed, altered, and fragmented are more likely to be susceptible to climate stressors. Sea level rise poses a substantial risk to both leveed and un-leveed ecosystems.

However, due to the ongoing motivation for levee maintenance, leveed ecosystems have more opportunities for adaptation. Current tidal wetland ecosystems lack connections to upland transition sea level rise accommodation space, are vulnerable to sea level rise, and have fewer adaptation opportunities. Thus, restoring extensive tidal wetland areas with connections to upland accommodation space is critical for reducing tidal wetland vulnerability to sea level rise in the Delta. Air temperature is predicted to increase overall, and mean rainfall is predicted to increase. However, both fall and spring rainfall is expected to decrease. Ecosystems that depend on local rainfall and groundwater (e.g., wet meadows and seasonal wetlands) are highly vulnerable to changes in all three climate drivers: air temperature, local precipitation, and sea level rise.

**TODAY’S MEETING**

At today’s meeting, Council staff will update the Council on the status of Delta Adapts, present key findings from the equity, water supply, flooding, and ecosystem technical analyses, and describe the next steps. The Council will have the

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opportunity to ask questions about Delta Adapts and the selected key findings presented, as well as the methodology and stakeholder engagement process. Council staff will present the remaining results of the public draft Vulnerability Assessment, including the economic analysis, at the December 17, 2020, Council meeting. A written draft of the Vulnerability Assessment will be publicly available shortly following the December Council meeting. Council staff will be seeking Council endorsement of the final Vulnerability Assessment in early 2021.

**QUESTIONS TO CONSIDER**

1. Given our authority, what is the role of the Council in addressing these climate vulnerabilities? What is the role of other agencies and organizations?
2. What other uses are there for the equity results and the social vulnerability index?
3. Based on these findings, what are some initial adaptation strategies to consider?

**FISCAL INFORMATION**

Not applicable.

**LIST OF ATTACHMENTS**

Attachment 1: Social Vulnerability Index Scores

Attachment 2: Flood Maps

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ATTACHMENT 1: SOCIAL VULNERABILITY MAP

