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About this draft: This is a working draft. It is incomplete. The chapter contains placeholders for some figures and tables. Much of the data is missing. Full discussion of some topics may be incomplete. This is the second of several drafts to be circulated in 2008 before the public review draft is distributed in December.

Subgroup: Improve Flood Management

Chapter [#] Flood Susceptibility Modification

Flood susceptibility modification is one of four strategies specifically intended to improve flood management. It is a strategy to reduce disruption by avoiding hazardous, uneconomic, or unwise use of floodplains. Other flood management strategies are flood impact modification, floodflow modification, and floodplain restoration (see chapters in volume 2). Additionally, other resource management strategies discussed in California Water Plan Update 2009 may provide flood management benefits.

The selective application of this suite of strategies creates an opportunity to engage in Integrated Flood Management, a process that promotes a comprehensive approach to flood management that considers land and water resources at a watershed scale within the context of Integrated Regional Water Management, which aims to maximize the benefits of floodplains and minimize the loss of life and damage to property from flooding.

Flood Susceptibility Modification in California

Background

Traditionally, flood management has relied on physical improvements which divert or reduce flood waters and avoid damage to lives and property. Often referred to as “flood control,” this concept favored physical modification of stream channels, dams and surface impoundments, levees, and other structures that altered or confined natural watercourses. More recently, the emphasis has shifted to a more integrated approach that includes both structural and non-structural methods and seeks to enhance the ability of undeveloped floodplains and open spaces to reduce the incidence of flood events and the implementation of land use practices that minimize the risk to lives and property. This multi-faceted approach to flood management relies on the integration of multiple strategies to achieve the broad goal of improving flood management.

To identify statewide flood risks and inform the State’s flood management policies and investment decisions, DWR has initiated the FloodSAFE California program. The goals of the FloodSAFE program are: 1) Reduce the Chance of Flooding – Reduce the frequency and size of floods that could damage California communities, homes and property, and critical public infrastructure; 2) Reduce the Consequences of Flooding – Take actions prior to flooding that will help reduce the adverse consequences of floods when they do occur and allow for quicker recovery after flooding; 3) Sustain Economic Growth – Provide continuing opportunities for prudent economic development that supports robust regional and statewide economies without creating additional flood risk; 4) Protect and Enhance Ecosystems – Improve flood management systems in ways that protect, restore and where possible enhance ecosystems and other public trust resources; and 5) Promote Sustainability – Take actions that improve compatibility with the

natural environment and reduce the expected costs to operate and maintain flood management systems into the future.

Description

Flood Susceptibility Modification includes the following types of projects, programs, and policies: 1) Floodplain Regulation; 2) Development and Redevelopment Policies; 3) Design and Location of Facilities; 4) Housing and Building Codes; 5) Flood Proofing; and 6) Flood Forecasting and Warning.

Floodplain Regulation includes land use policies which restrict the extent of development adjacent to streams and rivers in those areas which may be subject to periodic flooding or inundation. These measures may include measures to restrict or prohibit development within floodplains. Where development is permitted measures may require minimum protection of buildings and other development from potential flood damage (such as flood-proofing, described below). It may also include acquisition of floodplain lands through purchase or easements and measures intended to restore the natural, beneficial functions and values of the floodplain.

Development and Redevelopment Policies include land use practices that are designed to reduce flood risks, reduce the severity of potential floods, and expedite recovery after floods. This may include floodplain regulation (described above), stream protection ordinances, stormwater management practices, open space preservation, and watershed management programs. The intent of these practices is to reduce risk to structures by limiting development in flood prone areas, preserving the ability of water courses, wetlands, and open space to absorb precipitation and slowly release runoff, and reducing the extent of impervious surfaces. Redevelopment policies may include measures which impose conditions on future construction that restrict the size and placement of structures and pavements and encourage the long-term restoration of streams and floodplains.

Design and Location of Facilities includes measures that restrict development within floodplains or require design features which reduce potential flood damage (such as flood proofing below).

Housing and Building Codes include specific measures which reduce flood damage (such as flood proofing), preserve egress routes during high water events, such as rooftop exits in areas subject to deep flooding, or require that streets serving development are elevated above anticipated water levels to ensure safe egress from flooded areas.

Flood Proofing consists of measures which render buildings and their contents less vulnerable to floods through structural changes to existing buildings and specific design features of new buildings. These measures can include impervious walls without any openings and valves on sewer lines that automatically close from back pressure. Alternatively, the lowest floor could be completely open, consisting of open columns that create a covered patio or storage area.

Flood Forecasting and Warning involves the forecasting of river stages and the timely notification of responsible authorities so that plans for evacuation of people and property can be implemented. This technique is possible when there is sufficient time lapse between the occurrence of precipitation and the time when the ensuing runoff reaches the stream channel, causing water levels to rise. The time lag between the precipitation and the rise of water levels depends on the length and configuration of the watershed and may be on the order of hours or days. Factors which influence the benefits of flood warnings include: reliability of the precipitation forecast,

length of forecast warning time, magnitude of reducible damage, and efficiency of response to a warning.

Connections to Other Resource Management Strategies

As discussed above, this strategy is one of four specifically intended to improve flood management. The other three strategies (flood modification, flood impact modification, and floodplain restoration) are addressed in other chapters. The concept of integrated flood management relies on the application of multiple strategies to achieve a comprehensive effect. In addition to these key strategies, other strategies included in the Water Plan also have the potential to provide flood management benefits and may be included as an element of integrated flood management. Potential flood management benefits from other resource management strategies include:

- **Conjunctive management and groundwater storage:** Diversions of surface water for groundwater infiltration could enhance flood management by reducing flows.
- **Conveyance:** Improvements to regional water supply distribution systems could enhance the potential for flood flow conveyance.
- **Ecosystem restoration:** Ecosystem restoration can enhance the ability of open spaces to absorb rainfall and runoff and reduce the potential for flood events, or enhance recovery after flood events.
- **Surface storage:** Reservoirs can be designed to provide storage for flood flows, thereby reducing downstream flood peaks or volumes.
- **System reoperation:** Reoperation of reservoirs constructed for water supply purposes could provide opportunities to preserve and/or enhance flood management capabilities, by providing for the storage of flood flows.
- **Urban runoff management:** Management of urban runoff for purposes of improving water quality can preserve and/or enhance flood management by designing management practices to reduce or delay flood peaks.
- **Watershed management:** Watershed management can promote the retention of open space and habitat which can reduce the severity of flood events and promote recovery after flood events.

Potential Benefits of Flood Susceptibility Modification

The potential benefits of flood susceptibility modification for each hydrologic region depend on the extent of current and projected future development within floodplains and the willingness of local jurisdictions to enact land use policies and practices which reduce exposure to flood risks.

Inter-regional benefits associated with flood susceptibility modification are limited, as the conveyance of flood flows does not occur between hydrologic regions and the affect of land use regulation within most regions is unlikely to generate benefits to other regions. However, the implementation of flood susceptibility modification within the Mountain Counties special interest area has the potential to provide benefit to downstream areas in the Sacramento and San Joaquin regions and improvements in the Sacramento and San Joaquin regions would provide benefit to the Delta Region. Statewide benefits from flood susceptibility modification accrue from reducing the potential magnitude of State assistance that may be needed following future flood events.

Widespread public knowledge of potential for climate change may provide new opportunities to address flood management issues. Implementation of this strategy is not expected to provide benefits to water supply; drought preparedness; water quality, energy (consumption or supply), or resource stewardship.

Potential Costs of Flood Susceptibility Modification

The Department of Water Resources is currently working to identify the costs of improving flood management on a statewide basis. Included in this effort is the Central Valley Flood Protection Plan, a Statewide Flood Management Planning Project, and support for enhanced regional flood management through Integrated Regional Water Management (IRWM) plans. Collectively, these efforts will identify flood risks, propose feasible flood management improvements and quantify the cost of implementing the identified improvements. Some preliminary information may be available to inform Update 2009 of the Water Plan, but the bulk of this information may not be available until the subsequent Update of the Water Plan.

Major Issues Facing Flood Susceptibility Modification

Implementation of flood susceptibility modification will not adversely affect drought preparedness, water quality or energy consumption. As an element of Integrated Flood Management, this strategy will enhance flood management. Promotion of this strategy as an element of Integrated Regional Water Management is unlikely to create challenges, as the implementation floodplain management measures are not likely to interfere other forms of water resource management.

The costs of implementing improved floodplain regulation are not substantive (as capital costs are low), but population growth and development pressures may impede enhancements to floodplain management.

As climate change could increase the magnitude of future flood events, climate change will create new challenges to flood management measures. As current models of global climate change have not been localized to individual watersheds, specific flood impact predictions have not been developed for most locations, making planning for nonstructural improvements problematic. Expanded implementation of integrated flood management may be the best approach. Implementation of this strategy (changed regulation and building codes) is not anticipated to be directly affected by climate change.

Currently, the extent of flood management needs across the state are not well documented, although some local flood management plans (and multi-hazard mitigation plans) may describe local needs, but coverage of such plans is not statewide. Effective implementation of floodplain regulation and development policies relies upon reliable information about potential flood risks. As many regions lack current hydrologic information or hydraulic models that are needed to estimate flood risk, the state may need to consider investments in data collection and analysis to address data gaps and improve understanding of potential flood risks.

Recommendations to Facilitate Flood Susceptibility Modification

Consistent with the recommendations of the FloodSAFE Strategic Plan:

- The Department of Water Resources should develop a comprehensive Central Valley Flood Protection Plan (as described in SB5) with extensive stakeholder input by January 1, 2012.
- The Department of Water Resources should identify opportunities and needs to improve integrated flood management statewide and develop a financing strategy by January 1, 2012.
- The Department of Water Resources should develop a strategy to provide incentives and support for the creation and maintenance of IRWM plans that address regional flood management issues by January 1, 2012.

Selected References

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