

Central Valley Flood Protection Plan

Round 1 Management Action Workshops

Draft Initial Management Actions

A management action is a specific structural or nonstructural strategy, action, or tactic that contributes to the Central Valley Flood Protection Plan (CVFPP) goals and addresses identified flood management problems in the Systemwide Planning Area, including any identified deficiencies in the State Plan of Flood Control (refer to *CVFPP Interim Progress Summary No. 1*). Management actions may range from potential policy or institutional changes, to recommendations for operational and physical changes to the flood management system. Management actions may address one or more CVFPP goals and are the “building blocks” for regional solutions and eventually systemwide solutions.

An initial set of management actions was developed by consolidating a large number of compiled actions and recommendations from published studies and reports, and input from Regional Conditions and Topic Work Groups during CVFPP Phase 1 activities. DWR subject-matter experts provided a preliminary evaluation of the environmental, economic, technical, and social consideration of the identified management actions. Each management action was evaluated against a uniform set of criteria to allow for a consistent comparative analysis.

Management Actions Workshops will refine the initial management actions and develop additional actions to augment this initial set of management actions. For information on Phase 2 Workshops, refer to *Attendee’s Guide to Phase 2 Workshops* available at www.water.ca.gov/cvfmp/.

Each management action is evaluated using the *Management Actions Evaluation Form*. For description of the form sections refer to the *Reader’s Guide to the Management Actions Evaluation Form* available at www.water.ca.gov/cvfmp/.

To provide detailed written comments on the management action description and evaluation, use the fillable PDF *Comments Form* available at www.water.ca.gov/cvfmp/.

Draft Disaster Preparedness & Flood Warning Management Actions

ID	Management Actions Title
MA-063	Coordinate flood response planning and clarify roles and responsibilities related to flood preparedness and emergency response.
MA-064	Improve communication and public awareness of emergency response procedures and terminology.
MA-065	Establish standard flood warning systems and procedures.
MA-066	Improve stream gage network for forecasting purposes.
MA-067	Implement advanced weather forecast-based operations to increase reservoir management flexibility.
MA-068	Create systemwide levee instrumentation for early warning systems.

DRAFT Management Action Evaluation

Management Action Title:

MA-063

Coordinate flood response planning and clarify roles and responsibilities related to flood preparedness and emergency response.

Description:

Problem:

Unclear roles for local (city and county) and State agencies in supporting floodfight operations can impede quick and effective floodfighting during a major flood event. Some agencies and organizations charged with responding in the field during a flood emergency lack the capacity, resources, and interagency coordination necessary to carry out these duties effectively. Due to the long length of time between major floods, only a limited number of emergency response staff have significant flood response experience, technical expertise, or local understanding. This is also related to limited conduct or participation in emergency response exercises between flood events. Further, there is infrequent coordination between agencies and limited ability to advance new technologies and science related to levee breaches and floodfighting.

Desired Outcome:

Reduce the consequences of flooding by clarifying roles and responsibilities, improving training and the capacity of emergency response staff, and increasing coordination at all levels of government.

Methodology:

This management action could include a broad range of tactics at the state and local levels to clarify roles, increase communication, and improve the effectiveness of response to floods. These tactics could include promoting flood contingency and response planning at local and regional levels, and establishing a team to review current regional and local flood emergency procedures, response capacities, and communication capabilities for potential updates and improvements. Maintenance System Specialist committees could be reconvened to review and update Flood Emergency Action Team (FEAT) guidance documents and recommendations, in coordination with CalEMA. DWR could refine and clarify staff assignments and responsibilities related to flood fighting and emergency response, and put mechanisms in place to facilitate payment of vendors. Actions could also be taken to advance the science and awareness of rapid levee breach repair methods to facilitate repairs and speed recovery efforts. Joint field training exercises and briefings, in conjunction with CalEMA, could be facilitated to test and refine response procedures, communications, and logistics, and educate response staff.

CVFPP Goals

Contributes Significantly to:

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|--|
| <input checked="" type="checkbox"/> Improve Flood Risk Management
<input type="checkbox"/> Improve Operation and Maintenance
<input type="checkbox"/> Promote Ecosystem Functions | <input checked="" type="checkbox"/> Improve Institutional Support
<input type="checkbox"/> Promote Multi-Benefit Projects |
|---|--|

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.

Advantages:

- Low Capital Cost.
- Will reduce long-term emergency response costs due to economies of scale and increased coordination.

Disadvantages:

- Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult.
- Funding for local emergency response agencies has been challenging.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to medium. Policy MAs will tend to have a substantially lower capital cost than other MAs that involve physical construction. Example of capital investments include: funding for planning activities, communication system upgrades, joint training exercises, etc.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments, State, and federal agencies for pre-flood emergency response and contingency planning.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved emergency response planning would facilitate consistent and timely response during flooding events, which could reduce potential flood damages and recovery needs. Improved communication would increase response efficiency and effectiveness.

Flood fighting? (Increase, Decrease, or No Significant Change)

This MA contributes to effective and cost efficient floodfighting by improving communication, technology, and training and leveraging regional response capabilities.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential decrease. Improved flood preparedness could reduce the consequences of flooding, and more successful floodfighting has the potential to reduce the levee breaches and the subsequent frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves public safety by reducing consequences when flooding occurs. Better coordination and planning among all emergency responders ensures faster and more effective response (flood warning, evacuations, etc.).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High potential for political and public support; institutionally, support also exists, though opinions on how to implement and

fund these actions likely differ. Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult. Local agency participation may be affected by lack of funding.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk. Improving emergency response planning reduces consequences of flooding (potential damages to life and property).

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Emergency response planning is equally important to urban, small, and non-urban communities. The need for improvement varies. There is greater opportunity for making improvements in non-urban areas relative to urban areas.

Regional Applicability:

All regions, though Delta as special needs because of access and egress issues.

Integration with Other Programs:

DWR: Statewide Emergency Operations Plans (HAFOO), DWR Delta Flood Emergency Preparedness and Response Plan (HAFOO), Delta Emergency Operation Plan (HAFOO). Federal: FEMA, USACE, and other federal disaster assistance programs.

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Flood Warning: Responding to California's Flood Crisis.; RCR; Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title:

MA-064

Improve communication and public awareness of emergency response procedures and terminology.

Description:
Problem:

The public's response to any emergency is based on an understanding of the nature of the emergency, the potential hazards, the likely response of emergency services, and knowledge of what individuals and groups should do to increase their chances of survival and recovery. Public awareness and education prior to a flood emergency directly affects emergency response and recovery efforts. There is a need to educate the public on potential flood risks and how they should respond in a flood emergency.

Desired Outcome:

Through education, there is an opportunity to reduce loss of life from flooding and facilitate effective evacuation.

Methodology:

Effective hazard communication plans should be developed that use standardized evacuation terminology, and these plans should effectively communicated to the public. For instance, DWR could create simple, standardized flood threat levels (Flood Threat Condition 1 through 4, for example) for flood threat monitoring and management to assign appropriate flood response levels; these standardized flood threat levels could also be easily displayed on maps and used in public media advisories. Public outreach meetings could be conducted to notify property owners of flood risks, safety measures, and evacuation routes.

CVFPP Goals
Contributes Significantly to:

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Improve Flood Risk Management | <input checked="" type="checkbox"/> Improve Institutional Support |
| <input type="checkbox"/> Improve Operation and Maintenance | <input type="checkbox"/> Promote Multi-Benefit Projects |
| <input type="checkbox"/> Promote Ecosystem Functions | |

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation. Should investigate combining with other consolidated MAs in this category. State participation in this MA (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages:

- Low capital cost.
- Reduces long-term emergency response costs.
- Education may lead to more informed decisions and reduced residual risk.

Disadvantages:

- Small or non-urban communities may have limited funding and institutional capacity.

Economic Considerations:
Capital Cost? (High, Medium, Low)

Low. Policy MAs tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with local governments for developing hazard communication plans and conducting education

outreach meetings.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved communication and public awareness of emergency response procedures and terminology would reduce potential for damages and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No change. This MA contributes to flood emergency response but not to flood fighting coordination.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

Potential decrease. Educating the public on flood risks could help discourage support for development in flood prone areas.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Improved communication and public awareness would reduce the consequences of flooding and thereby reduce State Flood responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potentially improves public safety by increasing public awareness of flood emergency response.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved flood response may protect nearby resources.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Politically and publicly acceptable at the State, regional, and local levels. Some smaller local governments may be limited in their funding and institutional capacity to create hazard communication plans and education outreach without additional assistance.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

None.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Small or non-urban communities may have limited funding and institutional capacity to create hazard communication plans and education outreach without additional assistance.

Regional Applicability:

All regions.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation**Management Action Title:**

MA-065

Establish standard flood warning systems and procedures.

Description:*Problem:*

Warning affected citizens when a flood emergency is occurring or is imminent promotes public safety. Effective plans to alert the public of personal protective actions they can take currently exist in areas of the Central Valley. However, there are opportunities to enhance these plans. While some jurisdictions have established flood warning systems and procedures, other jurisdictions lack them completely. This can cause confusion among the public when responding to a flood emergency.

Desired Outcome:

This management action would increase public awareness of flood emergencies and increase time for the public to implement home and business emergency actions.

Methodology:

In coordination with existing systems, establish enhanced standard flood warning procedures, terminology and install warning systems that can be easily and quickly implemented by any 90% of communities greater than 1,000 people by 2025.

CVFPP Goals*Contributes Significantly to:*

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Improve Flood Risk Management | <input checked="" type="checkbox"/> Improve Institutional Support |
| <input type="checkbox"/> Improve Operation and Maintenance | <input type="checkbox"/> Promote Multi-Benefit Projects |
| <input type="checkbox"/> Promote Ecosystem Functions | |

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low capital cost.
- Would help reduce loss of life from flooding.
- Would help reduce emergency response costs.

Disadvantages:

- Small or non-urban communities may have limited funding and institutional capacity to create and adopt standard warning systems and procedures.

Economic Considerations:*Capital Cost? (High, Medium, Low)*

Low. Policy MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments for flood warning systems; federal cost sharing is uncertain under current federal grant/funding opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved flood warning systems and procedures would increase public awareness and preparedness of personal protective actions they can take to respond to flood emergencies.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change.

Effect on Damage to Critical Public Infrastructure?

Region specific. Some communities without flood warning systems and procedures would likely experience reduced damage to critical public infrastructure due to more coordinated emergency response activities. Communities already with warning systems and procedures in place may not experience a change in damage on critical public infrastructure.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Providing early flood warning and notification would improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically acceptable at the State and local levels. Some smaller local governments may be limited in their funding and institutional capacity to adopt standard flood warning systems and procedures.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Small or non-urban communities may have limited funding and institutional capacity to create and adopt standard warning systems and procedures.

Regional Applicability:

All regions.

Integration with Other Programs:

Joint DWR/NWS Flood Warning Program (HAFOO)

References:

Flood Warning: Responding to California's Flood Crisis.; California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study

DRAFT Management Action Evaluation**Management Action Title:**

MA-066

Improve stream gage network for forecasting purposes.

Description:*Problem:*

Flood forecasting models are limited, in part, by the quantity and quality of available stream gage network data. Additional sensors and stations are needed to improve the quality of flood and reservoir inflow forecasts.

Desired Outcome:

Install additional stream gages and data sensors to improve the quality of flood and reservoir inflow forecasts.

Methodology:

DWR should work with the USGS to install, maintain, and provide priority funding for a comprehensive stream gage network that would improve flood forecasting and monitoring. This network would include real-time gaging and dual path telemetry for river stage, rainfall, and temperature data. Real-time data, its timely availability, and real-time data quantities and quality are all critical data input to the forecasting models and contribute to improving forecasting quality and timeliness.

CVFPP Goals*Contributes Significantly to:*

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Improve Flood Risk Management | <input checked="" type="checkbox"/> Improve Institutional Support |
| <input type="checkbox"/> Improve Operation and Maintenance | <input type="checkbox"/> Promote Multi-Benefit Projects |
| <input type="checkbox"/> Promote Ecosystem Functions | |

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low Capital Cost.
- High potential for federal cost share.
- Will decrease costs for floodfighting and emergency response and recovery.

Disadvantages:

- Requires significant effort to maintain stream gage network.

Economic Considerations:*Capital Cost? (High, Medium, Low)*

Low. Primary capital costs would consist of installing new gaging stations.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for the stream gage network. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs would increase due to flood forecasting efforts and increased coordination with operators.

Potential for Cost-Sharing?

High potential for Federal cost sharing via contributions to existing federal project purposes (flood control and water supply)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved flood forecasting would provide additional time for emergency response activities.

Flood fighting? (Increase, Decrease, or No Significant Change)

With improved flood forecasting, floodfighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated in advance of flood events. Improved forecasting would also assist in prioritization of floodfight activities and other emergency response activities.

Effect on Damage to Critical Public Infrastructure?

Flood forecasting would provide more time for emergency preparedness and response to protect critical public infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Improving the stream gage network would result in minor temporary impacts to riparian and aquatic habitat.

Permitting Considerations?

Installation of new stream gage stations may require potentially lengthy permitting.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improving flood forecasting would provide early warning and notification to flood management system operators to protect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve flood forecasting would reside in the State and Federal levels of government.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

Urban, Small Community, and Non-Urban Considerations:

None.

Regional Applicability:

All regions.

Integration with Other Programs:

Forecast-Coordinated Operations Program (HAFOO), Forecast-Based Operations Program (HAFOO), potential integration with river restoration projects/programs (e.g., San Joaquin River restoration programs).

References:

California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title:

MA-067

Implement advanced weather forecast-based operations to increase reservoir management flexibility.

Description:

Problem:

During the flood season, reservoir operators currently follow the Water Control Manual and corresponding Flood Control Diagram developed by USACE for their reservoir operations. Most of the flood control diagrams are based on conditions currently occurring in the reservoir and often do not provide the operational flexibility needed to improve flood protection and water supply. Flood control diagrams also do not take advantage of the most recent advancements in weather and river forecasting and data gathering and exchange to minimize the downstream impacts of reservoir releases.

Desired Outcome:

Forecast-based operations provide operational flexibility based on snow accumulations in the basin, basin wetness, runoff forecasts, quantitative precipitation forecasts, and climate change. Increasing flexibility of operations at flood control reservoirs using advanced forecasting information would be explored for many reservoirs throughout the Central Valley.

Methodology:

Forecast-based operations would provide operators information on future reservoir inflows and would allow them to better save the flood management storage for the peak of the storm to help minimize the risk of exceeding river channel capacity. Knowledge of future flows and reservoir releases would increase the warning times to communities along the rivers and downstream of flood control reservoirs.

CVFPP Goals

Contributes Significantly to:

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|--|
| <input checked="" type="checkbox"/> Improve Flood Risk Management | <input checked="" type="checkbox"/> Improve Institutional Support |
| <input checked="" type="checkbox"/> Improve Operation and Maintenance | <input checked="" type="checkbox"/> Promote Multi-Benefit Projects |
| <input type="checkbox"/> Promote Ecosystem Functions | |

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low Capital Cost.
- Will decrease costs for many activities, including flood fighting, emergency response and recovery, and some O&M activities.

Disadvantages:

- Advanced weather forecast based operations are not proven in real-time operations.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Primary capital costs consist of developing weather forecasting and hydrologic models, and coordination with reservoir operators.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for the stream gage network. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs would increase due to flood forecasting efforts and increased coordination with operators.

Potential for Cost-Sharing?

Yes. Significant potential for local and federal government cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Forecast-based operations would facilitate consistent and timely response during flooding, which would reduce potential damage and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Decrease. Decreasing peak flows and improving notification processes would decrease long-term flood fighting costs. Forecasting would allow flood fighting efforts to be coordinated in advance of flood events.

Effect on Damage to Critical Public Infrastructure?

Decrease. Decreasing peak flows by operating reservoirs in advance of flood events would reduce damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the frequency and consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Decreasing peak flows and improving notification processes would improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

While forecast-based operations would be targeted to improve flood control, it could provide more flexibility in managing reservoirs to achieve other benefits (water supply, recreation, ecosystem needs, etc.)

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Forecast-coordinated operations have been developed on the Yuba-Feather River system and are being developed on some San Joaquin river reservoirs. Forecast-coordinated operations have thus proven to be politically and institutionally acceptable in some instances. However, forecast-based operations may face some political and institutional resistance because they could create binding rules that would restrict the flexibility of individual reservoir operators.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the frequency and consequences of flooding.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

Urban, Small Community, and Non-Urban Considerations:

None.

Regional Applicability:

All regions.

Integration with Other Programs:

Forecast-Coordinated Operations Program (HAFOO), Forecast-Based Operations Program (HAFOO)

References:

Environmental Sustainability Summary;

DRAFT Management Action Evaluation**Management Action Title:**

MA-068

Create systemwide levee instrumentation for early warning systems.

Description:*Problem:*

Flood emergencies in areas protected by the SPFC usually result from levee breaks. Warning affected citizens is then dependent not only on knowing when a flood peak will occur and how large it will be, but also on knowing the condition of the levees protecting those citizens. Currently, a system is in place to provide accurate and frequent information on river stage at several reporting gauging stations. However, the system is not set up to provide information on the conditions of the levees themselves. Accurate and timely instructions and information are needed to alert the public of personal protective actions they can take.

Desired Outcome:

Development of a network of telemetered sensors (piezometers and Optical-Time-Domain Reflectometry) that will provide information on seepage pressures and levee movement. Such information will be extremely useful for coordinating emergency response.

Methodology:

Flood forecasting and warning would be supplemented by a system of telemetered sensors (piezometers and Optical-Time-Domain Reflectometry) that would record and transmit seepage pressure and monitor levee movement along critical levee reaches. This would provide comprehensive predictions of floods and warning of flood danger from overstressed levees. This system could be installed first in levees protecting urban areas and then could be expanded in the future to protect less populated areas.

CVFPP Goals*Contributes Significantly to:*

Improve Institutional Support

Potentially Contributes to (Check all that apply):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Improve Flood Risk Management | <input checked="" type="checkbox"/> Improve Institutional Support |
| <input checked="" type="checkbox"/> Improve Operation and Maintenance | <input type="checkbox"/> Promote Multi-Benefit Projects |
| <input type="checkbox"/> Promote Ecosystem Functions | |

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- High potential for federal cost share.
- Would make flood fighting more effective.
- Would decrease costs of emergency response and recovery.
- Politically and institutionally very acceptable.

Disadvantages:

- Potentially high cost.

Economic Considerations:*Capital Cost? (High, Medium, Low)*

Low to moderate. Primary capital costs would consist of installing new early warning instrumentation. Due to the number of miles of levees, this could be moderately costly.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Knowing which levees are stressed during high water would help focus future O&M, thereby making it much more efficient.

Potential for Cost-Sharing?

High potential for Federal cost sharing via contributions to existing federal project purposes (flood control and water supply)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved levee early warning instrumentation would provide additional time for emergency response activities.

Flood fighting? (Increase, Decrease, or No Significant Change)

With improved levee early warning instrumentation, floodfighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated in advance of levee breaks .

Effect on Damage to Critical Public Infrastructure?

Early warning instrumentation would provide more time for emergency preparedness and response of critical public infrastructure.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Installing a levee early warning system would result in minor temporary impacts to riparian and aquatic habitat.

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve early warning instrumentation would reside in the State and Federal levels of government.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

None.

Technical Considerations:

Redirected Hydraulic Impacts?

Reduces residual risk by reducing the consequences of flooding.

Residual Risk?

None

Climate Change Adaptability:

Improving levee early warning instrumentation would provide early warning and notification to public safety officials.

Urban, Small Community, and Non-Urban Considerations:

All regions.

Regional Applicability:

Integration with Other Programs:

Integration with existing data collection system (CDEC)

References: