Emergency Preparedness Guidelines for Levees

A Guide for Owners and Operators

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Homeland Security

Preface

Responsibility for flood risk management in the United States is shared between Federal, State, and local government agencies; private-sector stakeholders; and the general public. Federal agencies such as the U.S. Army Corps of Engineers (USACE) and the Federal Emergency Management Agency (FEMA) have programs to assist states and communities in reducing flood damages and promoting sound flood risk management. The authority to determine how land is used in floodplains and to enforce flood-wise requirements is entirely the responsibility of State and local governments. As emergency preparedness constitutes an important element of a comprehensive flood risk management framework, public and private levee owners and operators should consider undertaking emergency planning efforts in order to properly respond to potential flood events, and other natural or manmade incidents that could result in human casualties, property destruction, and economic losses.

This document, which was prepared under the auspices of the Levee Sub-Sector Coordinating Council and Levee Sub-Sector Government Coordinating Council, aims to assist public and private stakeholders that have responsibilities as owners or operators in managing levees, floodwalls, pumping stations, and any other components of flood risk management systems. The intent of this document is to provide guidance in preparing for, and responding to, potential natural and manmade incidents at levees.

This document includes basic recommendations regarding how to plan and prepare for high water events and identifies some practical steps that could be considered before, during, and after such events. The document also provides some basic guidance on how to develop an emergency preparedness plan and introduces basic security concepts. Some sections are loosely adopted from the National Incident Management System (NIMS) that was issued by FEMA in 2008, and is based on the Incident Command System (ICS). This document also utilizes material from the Dams Sector Crisis Management Handbook.

Public and private stakeholders with responsibilities as owners or operators in managing levees are encouraged to review and apply this guidance to their facility, as appropriate. Stakeholders are also urged to actively coordinate emergency plans with the appropriate State or local emergency management organizations in order to follow the corresponding emergency planning requirements.

For additional information, please contact the Dams Sector-Specific Agency at dams@hq.dhs.gov.

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I. Emergency Preparedness

Many of the Nation's levees were built more than 50 years ago with the intent of protecting crops from flooding. Over the past few decades, housing and commercial development on land protected by levees has increased the risk to public health and safety associated with potential levee failure. According to the American Society of Civil Engineers, "continued population growth and economic development behind levees is considered to be the dominant factor in the national flood risk equation, outpacing the effects of increased chance of flood occurrence and the degradation of levees. Unfortunately, lands protected by levees have not always been developed in a manner that recognizes the benefits of the rivers and manages the risk of flooding."

The U.S. Department of Homeland Security (DHS) considers levees to be part of the Nation's critical infrastructure and collaborates with corresponding public and private partners to identify levees that present the greatest risk to the Nation. DHS also coordinates corresponding protective programs that utilize an all-hazards approach to risks (considering manmade and natural incidents). This collaboration highlights the importance of protecting and ensuring the safety of the Nation's levees with contribution from all levels of government and the private sector. As demonstrated during Hurricane Katrina in 2005, however, breaching of levees and subsequent flooding is still a possibility regardless of elaborate protection and safety programs. It is, therefore, incumbent upon all levee owners and operators to maintain an effective emergency preparedness plan.

Preparedness actions are aimed at planning, organizing, training, equipping, exercising, evaluating, and implementing corrective actions to ensure effective coordination during incident response. Preparedness activities may include development of emergency plans, communication strategies, exercises, and training emergency response teams; as well as management and stockpile of disaster supplies and equipment. Emergency preparedness plans are intended to provide a clear and effective structure with which to manage an emergency. For levee systems, emergency preparedness plans focus on actions that may be considered during a flooding event. While flooding caused by a levee breach is the most common emergency facing a levee, the plan should also consider other potential emergency situations.

Large levee systems with multiple pumping stations and drains require more detailed plans than smaller systems. As a minimum, however, levee owners and operators should maintain at least an organizational chart or roster with lists or maps of important project features. If possible, emergency planning efforts should also address issues related to delegation of authority and responsibility, with periodic updates to account for changes in personnel.

Emergency preparedness efforts may also consider short-term situations that might arise during the life of the project. For example, if a culvert that runs through a levee is being replaced, a plan may be needed in case there is a flood during the construction period, during which time levee integrity is lacking.

Emergency planning may cover other key aspects such as potential assembly or staging areas for flooding events, location of earth borrow sites, and procedures for maintaining records of equipment, manpower, and supplies. Understanding no plan can guarantee that a levee system will not fail under all circumstances, levee owners and operators are encouraged to work with local public safety officials to assist them in developing effective evacuation plans.

Figure 1 - Sacramento River at Miller Park, Sacramento, California
(Source: U.S. Army Corps of Engineers Digital Visual Library, 2010)

II. Developing an Emergency Preparedness Plan

An emergency preparedness plan should address a variety of issues including evacuation activities, communication protocols with local emergency operations centers and the general public, individual roles and responsibilities during an emergency, and supplies and materials that may be needed. The plan should also establish priorities for responding to an emergency such as:

- Protection of life and property;
- Communication of hazardous conditions to public agencies and the public; and
- Restoration of normal operations.

The plan should identify the local emergency management agency that will respond to and manage an emergency, as well as describe how emergency conditions are identified and reported. It should clearly identify who has the authority to activate the emergency preparedness plan and provide a broad description of the conditions that will require activation of the plan, such as adverse weather projections, increased water flows, potential or actual levee breaches, etc. These criteria should be very general, as the decision to activate an emergency preparedness plan ultimately resides with the informed judgment of senior management.

One critical element of the emergency preparedness plan is the identification of an emergency operations center where key personnel can coordinate the response. This can be as basic as a command vehicle or a conference room. The location selected should contain sufficient resources to manage an emergency (e.g., backup power, communications tools, inundation maps, engineering records, lists of vendors, and emergency inventory resources). While not always practical, the identification of an alternate emergency operations center is also recommended in the event that the primary location is unavailable.

The plan should also address steps to be taken prior to an emergency, such as establishing close working relationships with State and local emergency management and public safety agencies. While government agencies are responsible for declaring the need to evacuate a given area, levee owners and operators are encouraged to establish communication with residents and businesses whose properties could potentially be impacted by a levee breach.

Plan Development

A person with a sufficient level of authority should be assigned to develop and maintain the emergency preparedness plan based on guidance from senior management. The plan should be created by levee personnel with assistance and input from local emergency responders and other community members who maintain responsibilities during an emergency situation. Development of emergency plans should be actively coordinated with the appropriate State or local emergency management organizations that can also advise of any State or local emergency planning requirements.

In developing an emergency preparedness plan, personnel should engage all critical aspects of the organization, including operations and maintenance, engineering, and key support operations

such as purchasing, facilities, and information technology. Levee personnel responsible for managing external relations may also play an important role in the development of an emergency preparedness plan. Once the plan has been completed, it should be reviewed and approved by senior management. The plan should also be exercised with all stakeholders on a scheduled basis.

Plan Management

An emergency preparedness plan should be reviewed periodically, after events triggering its activation, or after unusual or unanticipated incidents.

Periodic plan updates should include verification that sources of emergency equipment, contact names, and telephone numbers are current. The resource and personnel information should be located in a separate document for security and privacy purposes. A review of evacuation routes and emergency shelter locations should be established to determine if they fulfill the evacuation and sheltering needs of the community. If changes are made, they should be cleared for dissemination and provided to the general public.

After an actual event or exercise, levee personnel should closely examine actions taken to determine whether they were effective and efficient. Given that floods may occur decades apart, it is important that information be recorded for use in future planning efforts. Debriefing sessions, with all participants represented, provide valuable feedback on lessons learned. Information obtained during these sessions may include actions that worked well, areas for improvement, and recommendations to resolve any outstanding issues or concerns.

Organizational Chart/Roster

One key component is the development of an emergency notification organizational chart ("flowchart") to establish who will be notified by whom and in what priority. The flowchart should include names and essential contact information (e.g., home, office, mobile, and pager numbers), and should also include essential public agencies that need to be notified. The flowchart should be kept internal and the document should be appropriately marked (e.g., For Internal Use Only, For Official Use Only, or any other relevant designation).

It is strongly recommended that levee owners and operators compile a directory including telephone numbers for the area's emergency operations center, local contractors, flood fight supply and equipment vendors, Red Cross, Salvation Army, hospitals, railroad and highway departments, and police and fire departments. In many communities, the corresponding emergency services organizations may be able to provide this information in support of emergency preparedness planning efforts.

Important Project Features

As a basic planning recommendation, levee owners and operators should develop and maintain either a list or annotated map that describes each project feature and areas of concern during a flood event. The list should clearly note:

- Low areas;
- Areas subject to boils;
- Areas of known seepage;
- Areas of recent rodent activity;
- Alternate access points to the levee (should the primary access point become impassible);
- Locations of drains that should be checked for closure; and
- Available sources and locations of sandbags, pumps, and other supplies.

Along with this information, levee owners and operators should develop and maintain a detailed table of project features that may need to be closed, such as floodgates, flap gates, etc. This table should denote the river level or other indicators that would signal at what point each feature should be closed. Moreover, the highway or railroad departments need to be contacted prior to closing roads or railroad tracks running through levees and floodwalls.

Annual Inspections

Levee owners and operators should consider a pre-flood season inspection program for flood control projects. When conducting pre-flood season inspections, levee personnel should document the condition of the project in an annual inspection report and also in the emergency preparedness plan. Appropriate items to document in this report include:

- Name/location of the levee;
- Date of inspection;
- Name of inspector;
- Project features that were inspected;
- Overall condition of project features;
- Maintenance that has been completed;
- Maintenance that is currently being performed;
- Maintenance items that need to be accomplished in the future;
- Photographs showing flood damages, deficiencies, and overall project condition; and
- Maintenance costs incurred for the flood control project that year.

Figure 2 - Levee inspection by boat (Source: U.S. Army Corps of Engineers Digital Visual Library, 2010)

III. Security Awareness

In addition to natural hazards, criminal or terrorist acts may also pose a potential threat to levees. Historically, terrorist groups have conducted surveillance of potential infrastructure targets. These efforts can be conducted over many months or even years. Additional surveillance may be conducted immediately prior to the attack to assess any security enhancements that have been implemented and to adjust the attack plan if necessary. Although there is no credible information indicating that terrorists have identified levees as potential targets, levee owners and operators should be aware of the possibility of a terrorist attack targeting levees and other flood risk reduction structures. Moreover, security protocols should be captured in a comprehensive preparedness program.

Awareness and continuous vigilance are vital to enhancing the security of levees and supporting facilities. As such, suspicious activities should be immediately reported to the corresponding local law enforcement, Federal Bureau of Investigation (FBI), or State and local Fusion Centers. Levee personnel should be alert to the following signs of possible surveillance attempts, particularly during periods of potential flooding or heightened national threat advisories:

- Presence of strangers or unknown vehicles in areas near or adjacent to the levee, particularly if observed over the course of multiple days.
- Individuals in accessible areas open to the public who do not fit the normal profile or behavior of walkers, joggers, boaters, or cyclists.
- Persons using cameras, video devices, or optical equipment to photograph or diagram levee structures or their support systems such as pumps, gates, electrical components, or communications facilities.
- Unusual aircraft flyovers or boating activities such as uncommon low-altitude flights, unattended boats, or unusual recovering or tossing of items.
- Cuts in fencing or gates, particularly to key areas of the levee structure with no resulting theft, vandalism, or other petty criminal activity.
- Unusual requests for information from persons approaching levee employees, friends, or family members; or calling, visiting, or sending e-mails with questions regarding the operation of the levee.
- Theft of marked vehicles, work clothes, or identification cards from levee personnel, contractors, or other authorized personnel.

The above list should not be considered all-inclusive, and personnel should use good judgment and experience to identify activities that are deemed to be suspicious. Some of these activities are difficult to pinpoint, especially in recreational areas, since many of the items used in surveillance efforts are also commonly used by campers, hikers, and nature photographers.

When reporting a suspicious activity, personnel should be prepared to provide detailed information regarding the suspicious behavior and a description of the persons, vehicles, etc. Any type of photographic evidence could effectively enhance the report, but care should be taken to ensure that personnel safety is not compromised. DHS, in coordination with public and private stakeholders, also developed a suspicious activity reporting tool available through the Homeland

Security Information Network-Critical Sectors (HSIN-CS) Dams Portal.[1] This reporting tool is intended to provide real-time awareness of potential suspicious activities occurring at the Nation's dams and levees, thus providing the opportunity to evaluate reports from a broad range of agencies and organizations. The tool is not intended to replace other reporting mechanisms, but rather enhance them by ensuring that levee owners and operators have the capability to evaluate reports from other stakeholders, agencies, and organizations in an effort to improve situational awareness. This information may also assist in determining whether operational changes or enhanced protective measures are warranted.

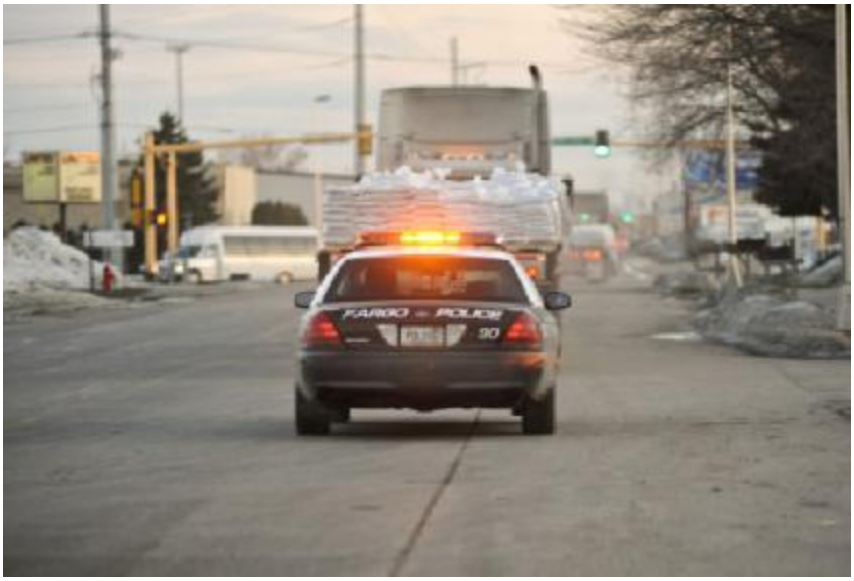

Figure 3 - Preparing for flooding in Fargo, North Dakota
(Source: FEMA Photo Library, 2010)

[1] HSIN-CS Dams Portal is a Web-based system that provides situational awareness and facilitates information sharing and collaboration with public and private stakeholders, domestically and internationally. For access, contact the Dams Sector-Specific Agency within the U.S. Department of Homeland Security at dams@hq.dhs.gov.

IV. Developing a Security Plan

To ensure all personnel are aware of established security measures and protocols, including proper procedures for reporting suspicious activities, levee owners and operators may choose to develop a security plan. The availability of a security plan can contribute greatly to the improvement of security as it details roles and responsibilities, physical and cybersecurity requirements, coordination with law enforcement officials, and procedures for reporting suspicious activities.

Levee owners and operators who desire more information about the development of a security plan should review the Levee Security Plan Template available through the HSIN-CS Dams Portal. This template is intended to serve as a practical tool to assist in the development of a security plan if it is deemed that one is necessary. Although it provides a general outline of a basic security plan, the document is not intended to be inclusive, and some of its elements may not be relevant to a particular levee system. The template, which includes sample language for consideration, highlights the fact that a team approach is highly recommended in the development of any security planning effort. Such a team could include representation of multiple disciplines and different organizational elements, as well as the corresponding law enforcement agencies.

The scope and content of the plan should be commensurate with the size and complexity of the facility. The plan should clearly outline employee responsibilities as they relate to security, and should also address coordination mechanisms with the corresponding law enforcement jurisdictions.

Basic elements of the security plan may include:

- Coordination with law enforcement agencies;
- Reporting and managing security incidents;
- Physical security;
- Communications and cybersecurity;
- Employee/contractor identification;
- Security contracting; and
- Coordination with emergency and operational plans.

The plan may describe any physical security measures that are routinely in place during normal operations, as well as the person responsible for those measures. Protective measures that may be considered include replacing and/or upgrading lock systems, installing gates or barriers to prevent vehicle entry to important facilities, and deploying security systems such as cameras, alarms, and access control systems. In addition, the plan should address any security issues associated with visitor access, recreation areas, tours, or other routine activities. The plan should also address the linkage between security activities and the levee's overall emergency preparedness plan.

Figure 4 - Law enforcement agencies assisting with flood response in South Kingston, Rhode Island (Source: FEMA Photo Library, 2010)

V. Importance of Evacuation Plans

During Hurricane Katrina in August 2005, the mayor of New Orleans ordered a mandatory evacuation of the entire city. Although not all residents heeded the warning, the evacuation that took place prevented an even worse catastrophe. This event illustrates the importance of having an effective evacuation plan to ensure that the area is properly evacuated in anticipation of a flooding event. This process requires collaboration among the levee owners and operators, local law enforcement officials, emergency management agencies, and other appropriate entities.

Government agencies are responsible for declaring the evacuation of a given area and will, in many instances, already have evacuation plans in place. If, however, levee owners and operators are unsure if this type of emergency planning has occurred, they are encouraged to contact the appropriate local emergency management agency to verify the status of existing plans. As a general recommendation, the development of evacuation plans should be done in coordination with the corresponding levee owners and operators. This ensures that levee monitoring protocols and notification procedures for communicating levee status to emergency response personnel are carried out effectively during an emergency.

While not responsible for developing an evacuation plan, levee owners and operators are encouraged to maintain close contact with appropriate government agencies during emergencies to provide timely and accurate information on levee conditions.

Figure 5 - Road in Red Wing, Minnesota, is closed due to flooding
(Source: FEMA Photo Library, 2010)

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VI. Importance of Training and Exercises

Depending on the characteristics of the levee system, some personnel may need training to operate, maintain, and patrol the levee system. It is recommended that training and exercises be periodically conducted in order to demonstrate how to operate the closure structures, respond to sandboils, and patrol the area during a flood. A plan developed for a flood response is not sufficient unless it has been practiced and communicated to those who will execute the plan's procedures. Training and exercises also inform personnel about the time and resources necessary to complete certain tasks. Important practical considerations and physical limitations that could be easily overlooked in a plan are often identified during an exercise.

As general guidance, basic training and exercise activities could include:

- Physical operation of project features (e.g., sluice gates, pumping stations, closure structures);
- Notification of emergency response personnel;
- Test of communications/backup communications system;
- Mobilization of monitoring teams and monitoring project features;
- Basic flood fight techniques;
- Coordination and control (between volunteers, patrols, operators, nearby levee districts, highway department, State emergency operations center, etc); and
- Dissemination of information to the public.

Exercises can be made more elaborate by including other emergencies that could take place during a flood (e.g., car accidents or gas spills occurring when interior streets or evacuation routes are flooded). Representatives from the relevant government agencies or response organizations may be able to assist in planning more complex exercises. Levee owners and operators are also encouraged to involve the State and local emergency operations center.

There are various types of exercises that can be conducted to test emergency preparedness plans, including:[2]

- *Workshop*: This is a discussion-based exercise often employed to determine objectives, develop scenarios, and define evaluation criteria in support of additional exercise activities. A workshop may also be used to familiarize staff with their roles and responsibilities, develop standard operating procedures (SOPs), or generate improvement plans. To be effective, workshops must be highly focused on a specific issue, and the desired outcome must be clearly defined.
- *Tabletop Exercise*: This is a discussion-based exercise that typically involves key personnel discussing hypothetical scenarios in an informal setting. Participants are encouraged to discuss issues in depth and develop decisions slowly, avoiding the spontaneous decision making behaviors that often occur under actual or simulated

[2] *Homeland Security Exercise and Evaluation Program (HSEEP)*, Volume I: HSEEP Overview and Exercise Program Management, February 2007.

emergency conditions. Players apply their knowledge and skills to a list of problems presented by the exercise facilitator, and the proposed solutions are discussed as a group.

- *Functional Exercise*: This is an operations-based exercise characterized by an actual response to emergency conditions. This type of exercise, in which movement of personnel and equipment is simulated, replicates operational realities through a scenario that requires rapid and effective response by trained personnel in a time-constrained environment.
- *Full-Scale Exercise*: This exercise includes all the elements of a functional exercise as well as actual deployment of field resources and engagement by outside parties, such as government agencies. This is an operations-based exercise in which personnel and resources are mobilized and deployed to the scene where they conduct their activities as if a real incident had occurred. This is the most resource intensive exercise format, and must be carefully controlled to ensure that persons who are not part of the exercise are informed and do not believe there is a real emergency.

Exercise activities may include participation in State and local emergency exercises where levee personnel can interact with multiple public safety agencies. Additional opportunities to identify improvement actions may be found through the review of the levee emergency preparedness plan after an activation triggered by a real-world incident.

Figure 6 - Government representatives, non-governmental organizations, and private industry partners participating at an exercise in Baton Rouge, Louisiana (Source: FEMA Photo Library, 2006)

Documentation of exercise activities is important to identify shortfalls that may exist in planning and coordination, training, personnel, equipment, and facilities. Immediately following the exercise, participants should conduct a “Hot Wash” to allow each individual to provide observations of what they considered to be challenges or successes that may not have been captured in formal evaluations. The information provided in the Hot Wash should be included in an After Action Report. After action reviews can provide valuable feedback on the effectiveness

of policies and procedures, identification of areas for improvement, and suggestions to correct deficiencies. Lessons learned during exercises should be incorporated into the emergency preparedness plan and subsequent training sessions.

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VII. Importance of Community Outreach

Many owners and operators experience difficulties obtaining the necessary funding and support needed to make repairs and improvements to their respective levees. The best examples of well-supported levee systems are those that have ensured that local businesses and citizens understand the flood hazard and the importance of the corresponding flood control system. While public awareness activities are not required, the key to ensuring support from your community lies in promoting a public awareness of the situation. Levee owners and operators may be able to promote a greater awareness of key issues through publications and planned public meetings, as described below:

Provide Public Materials

Many people, especially those living downstream of a levee, will take the time to read brochures detailing local flood protection if material is made available. Levee owners and operators might also release annual newsletters or articles for newspapers. Information should be presented on the following topics:

- Areas protected;
- How the system works;
- Potential impact on the community and ongoing costs for regular operation and maintenance;
- Consequences of levee failure;
- Local flood evacuation plans;
- Historical overview of past floods and experiences; and
- Flood response plans and procedures – how the community can contribute.

Schedule Public Meetings

Unless there is an actual flood, attendance at public meetings on flood control may be minimal, especially if the public is not properly informed on the issue. Levee owners and operators may find it useful to combine such meetings with discussions on local industry or other issues, or to raise certain issues during community events. To bolster additional community preparedness, levee personnel might ask to become involved with their public safety community's annual or special public awareness programs.

Awareness of Adjacent Systems

Personnel need to understand how adjacent sections of levees or components on private property impact the larger system. Even though these components might not be situated within the area of responsibility, the community could still be flooded if adjacent systems do not operate properly.

Figure 7 - Volunteers raising emergency levee in Valley City, North Dakota (Source: U.S. Army Corps of Engineers Digital Visual Library, 2011)

VIII. Managing Incidents: Structure and Responsibilities

As previously stated, the responsibility for responding effectively to a levee-related emergency is shared between levee owners and operators and local emergency management agencies. This includes ensuring that an emergency preparedness plan has been developed, personnel are trained on the plan, emergency operations centers are identified and maintained, and the plan is periodically exercised and updated. A specific person must be assigned direct responsibility for coordinating these activities.

The emergency preparedness plan should include guidance for determining when the plan will be activated and who is responsible for the activation. It should clearly indicate who is in charge of the response and that the necessary operational and support personnel are notified. It must also ensure that local emergency response activities are coordinated with the State and local emergency management agencies, public safety officials, and other levee systems where appropriate. While local emergency management officials are often responsible for communicating with the general public, levee owners and operators should ensure that those announcements are based on accurate information and should be prepared to communicate directly with the public, when necessary.

The basic incident management structure, identified in both the National Incident Management System (NIMS) and Incident Command System (ICS), consists of the following elements:

- Incident Commander (individual in charge);
- Operations (direction of field response);
- Planning (report status and development of response strategy);
- Logistics (material, contractor and other support); and
- Finance / Administration (general support and identifying financial impacts).

Incident Commander

There should only be one individual in charge of managing an emergency, and the emergency preparedness plan should clearly designate that individual. While this may be senior management, it may not always be the case. Under the NIMS/ICS structure, this person is designated as the Incident Commander although other designations more consistent with the levee system management structure are also appropriate. Levee owners and operators should also identify other individuals who can serve as alternates in the event the designated incident commander is not available, or to relieve that person if the situation continues for an extended period of time.

The Incident Commander is responsible for determining if the emergency preparedness plan should be activated. This could be based on potential flooding, sudden structural break, request from the State or local emergency management agency, or a number of other situations that, in management's judgment, requires activation of the plan.

Once the emergency preparedness plan is activated, the Incident Commander will be in charge of the overall emergency response effort, and will coordinate activities to identify and implement a

response strategy, establish priorities, and resolve any issues within the emergency management structure.

The Incident Commander is also responsible for coordinating and communicating the response with the State and local emergency management agency, other government entities, adjacent levee systems, etc. In certain circumstances, these duties may be assigned to one or more people such as a city/county liaison (liaison officer) or a person responsible for external communications (public information officer). Levee system owners and operators are strongly encouraged to establish relationships with State and local emergency management agencies and public safety officials prior to an emergency in order to facilitate the appropriate response during an actual event.

Individuals designated as public information officers should have experience and/or training in effective communications. They will be the primary points of contact to the public for the levee system during an emergency, and it is essential that messages are both accurate and timely.

Furthermore, employee and public safety is critical during an emergency. Therefore, it is important that responsibility for safety issues be given to a designated person who reports to the Incident Commander.

Operations Section

The Operations section is responsible for activities directly associated with responding to the emergency. These commonly include assessing the impact to the levee system and other facilities, dispatching repair crews and equipment, identifying materials and contractor resource requirements, and moving toward full restoration of normal operations.

This section is typically headed by the person responsible for day-to-day operations, maintenance, and/or construction activities for the levee system. As is the case with all emergency management positions, a number of alternates should be designated to ensure someone is always available and to provide relief as the emergency continues.

Depending on the size of the levee system, the Operations section can consist of a single person or a number of people separated by function (e.g., maintenance, construction, water supply), by geographical segments (e.g., North and South levee operations), or in any manner that works within the organizational structure of the levee system.

Planning Section

The Planning section collects, evaluates, and disseminates information regarding the nature of the emergency. This information is used to provide status reports within the emergency management organization so that all members are informed of the nature of the emergency and the progress being made. This could include manpower requirements, facilities impacted, materials requirements, etc. Documentation and status reports will greatly assist levee personnel in maintaining a record of actions taken during the course of the emergency.

Under the NIMS/ICS structure, the Planning section, in coordination with other parts of the management team, develops an overall strategy for responding to the emergency. However, that

responsibility can be assigned elsewhere such as with the Incident Commander or the Operations section.

The person responsible for the Planning section will vary depending on the size and complexity of the levee system. One possibility is the person responsible for engineering support, due to their close working relationship with operations staff and technical knowledge of the levee system. In a smaller system, this function could be combined into the Operations section.

Logistics Section

This section is responsible for meeting emergency support requirements. These needs will vary greatly, particularly in a sustained emergency situation. Examples include obtaining or contracting for critical equipment and construction materials, fuel, transportation, emergency communications, food services, medical services, and other items needed by the responding individuals.

This section should be led by the person responsible for general support services. While the makeup of this section will vary depending on the size and complexity of the levee system, input will be needed from personnel knowledgeable in the areas of warehouse operations, purchasing, facilities management, vehicle operations, telecommunications, and IT support.

Finance/Administrative Section

This section is responsible for providing financial and general administrative support during an emergency. The Finance/Administrative section is particularly responsible for capturing the costs associated with the emergency and ensuring that there are sufficient financial resources to manage the incident. This includes ensuring that payroll and vendor payment obligations are met, obtaining additional cash or lines of credit to support emergency expenses, managing claims issues, etc. This section is also responsible for providing general administrative support such as clerical staffing.

The leader of this section should be the person responsible for financial matters for the levee system. Other individuals who could take on this role are those responsible for payroll, vendor payments, and claims management.

Figure 8 - Incident Commander observes damage caused by flooding in Westminster, Vermont (Source: FEMA Photo Library, 2011)

Appendix A: Flood-Fighting Equipment[3]

Although each flood is unique, proper planning will improve response time and success. Levee owners and operators should maintain a stockpile of necessary supplies and equipment used to respond to typical high-water events. In a flood, stockpiled materials will provide the capability to quickly initiate a preliminary response while additional materials and equipment are being delivered.

The specific requirement for supplies depends on the size of the levee system and on past flood events. The best way to determine the necessary quantities is to look at the supplies that were utilized during previous floods. For example, if the levee system historically uses 1,500 sandbags in a flood response, a stockpile of 1,500 sandbags should be maintained in a protected area.

Sandbags

As stated above, levee owners and operators should maintain an adequate supply of sandbags to respond to typical high-water events. Polypropylene is the preferred material for sandbags, but burlap is a sufficient alternative. All sandbags have a limited shelf life and should be inspected annually and replaced when necessary. The stockpile of sandbags should be stored in a dry, protected location that does not expose the sandbags to sunlight. Continued sunlight and weather will rapidly deteriorate the sandbag material.

Plastic Sheeting

There are many applications for plastic sheeting during flood fights. If it is typically used in a community during a flood fight and there is any doubt about its availability during an emergency, it should be stockpiled in preparation of an event. Six millimeter (6 mm) polyethylene sheeting is the minimum thickness recommended for flood fighting applications.

Sandbag Filling Equipment and Supplies

If the levee system contains areas where large quantities of sandbags will be needed, a reliable method for filling them is also needed. Levee owners and operators may consider investing in equipment that will assist in completing this task in a more expeditious manner. There are several types of sandbagging machines available commercially, as well as other tactics utilizing common equipment that can be employed to enhance sandbag filling efficiency.

Emergency Lighting

It is strongly recommended that levee systems contain emergency lighting that is readily available for use during flood fights.

[3] *Owner's Manual for Flood Risk Management Systems (Draft)*, U.S. Army Corps of Engineers, EP 1130-2-552, January 2011.

Expedient Flood Fight Products

Industry has developed several temporary flood protection products that have proven to be effective, and in many cases, more expedient to install than traditional sandbag levees. There are numerous manufacturers of these products, although they typically fall into several primary categories: water-filled bladders, lined baskets that can be filled with sand or other material, and a wide variety of portable flood walls.

Communication System

A reliable communication system is vital to coordinating flood fighting efforts and for calling for assistance when needed. Cellular telephones work very well, but are limited in their capacity for communicating with multiple people at one time, potentially hindering rapid wide-spread communication during emergencies. Levee systems may also experience a service disruption during an incident if telephone traffic is very heavy. Given these potential problems, two-way radios are preferable as they are extremely reliable for short distances and can broadcast to several people at once.

Without a reliable communication system, any flood fighting effort will be much more difficult and will probably require additional manpower. Advances in communication technology are now enabling various communications systems to "speak" with one another without requiring a separate radio for each system. Many county and municipal public safety organizations are replacing legacy communications systems with these newer systems; in many instances, specific facilities such as nuclear power plants and prisons have been included in these upgrades. Levee owners may consider updating their systems to help consolidate communications.

Riprap for Erosion

It is recommended that the levee owners and operators develop plans to address erosion that may occur during a flood emergency. It might not always be necessary to stockpile riprap, but it is important to know the location and telephone numbers of local quarries capable of supplying riprap during an emergency. Some levee systems maintain a supply of gravel onsite in order to ensure levee access routes during an emergency.

Floatation Vests

The safety of workers and volunteers should always be the highest priority during a flood fight. Floatation coats or vests are recommended and should be worn at all times when working near the riverward crest of the levee, riverward side slope, or near fast moving water. Floodwaters can quickly sweep a person downstream, and hypothermia can set in quickly in cold water conditions.

Pumps

Similar to sandbags, pumps are a critical part of any flood fighting effort. Pumps aid in evacuating water inside the levee systems caused by interior drainage and/or seepage through the levees. Care should be taken to anchor pump discharge hoses to prevent water discharge from eroding levee material. Communities that experience frequent flooding should consider

purchasing one or more pumps that meet their specific requirements. If additional pumps are needed during a flood fight, the State or local government may make them available; although access will be prioritized during an emergency.

Sources of Borrow Material

Borrow sites for emergency levee repairs or construction should be identified in advance of a flood event. Special consideration should be given to accessing the borrow site, as well as accessibility from the borrow site to the levee.

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Appendix B: Flood-Fighting Response Activities[4]

Phase I: Preliminary Response Activities

Upon receipt of official information forecasting imminent high water, levee owners and operators should quickly mobilize a response team. All personnel involved in flood fighting operations should also be alerted immediately. If the levee system stretches many miles, definite sections of the levee should be assigned to individual levee personnel.

There are many ways that the State and local government can assist during a flood. For example, the State may provide trucks, tractors, radios, helicopters for emergency inspections, support from the National Guard, and financial assistance. If a levee system owner runs out of supplies needed for a flood fight, it is advisable to ask for assistance from State and local governments; if necessary, the State government will coordinate additional assistance from the Federal government. Levee owners and operators are also strongly encouraged to foster relationships with local emergency managers and the State emergency operations center; it is also advisable to include these stakeholders in exercises to ensure all personnel are prepared to respond to an incident in a unified and coordinated manner. Emergency managers and emergency management personnel should be kept informed of the condition of levee systems and ongoing situational updates during a flood response. It is vital that owners and operators be aware of the type of support that State and local governments can provide, and whom to contact in order to receive the necessary support.

In addition, during Phase I, levee personnel should:

- Review emergency preparedness plans and lessons from previous incidents and exercises and identify problem areas.
- Verify that personnel have access to gate keys, current rosters, listing of project features and closings, plans, and other critical items.
- Coordinate efforts with communities upstream and downstream;
- Alert the community to the potential for flooding. This will give them advance warning to take action and minimize potential damage to businesses and homes.
- Ensure State and local emergency operations centers are informed of the situation; and
- Begin documenting the situation, and send situation reports to the State or local emergency operations center, as appropriate.

Initial Project Inspection

As soon as notification of high water conditions is received, levee personnel should conduct thorough inspections of relevant areas, omitting nothing from the inspection based on adequate performance during past high water events. In addition to the items that are typically inspected during patrols (listed below), special attention should to be given to the following items during

[4] *Owner's Manual for Flood Risk Management Systems (Draft)*, U.S. Army Corps of Engineers, EP 1130-2-552, January 2011.

this initial inspection (note that several of these items can and should be accomplished annually and not only during a high water prediction):

- Condition of any recent levee repairs;
- Water conditions and any accumulation of trash, debris, ice, etc.;
- Transportation: roads, rail, and water access;
- Material: identify location, quantity, and conditions of all necessary tools and materials (e.g., sacks, sandbags, lumber, and lights) and distribute and store them at points where maintenance is anticipated.
- Communication: locate and check all two-way radios and telephones; and
- Drainage structures: most drainage structures are situated to convey interior drainage from low points of the protected area through the levee by gravity flow. Due to the location, drainage structures are generally subject to inundation at lower stages than most other project features, and special attention should be given to flap gates and other drainage structures that might not be accessible later.

Additional activities to complete during Phase I include:

- Review assignments for patrols, closings, etc.;
- Obtain lists of all construction equipment, motorboats, cars, earthmoving equipment, and trucks that can be made available.
- Assess needed support (e.g., vehicles, radios);
- Verify serviceability of flood fighting equipment;
- Record gauge readings and monitor river stages;
- Close the levee to the public;
- Install levee or floodwall closures as necessary. All road closings should be coordinated with the corresponding authorities before limiting road or rail access through the levee.
- Remove all hazardous materials and/or explosives from the vicinity of the levee.

Patrols

In order to minimize damage and prevent the levee from failing, any problems must be detected early and resolved accordingly. The entire levee should be patrolled at least once per day during Phase I and continue during Phase II. Patrols should be conducted by teams rather than individuals. Many of the tasks typically accomplished during high water inspections and patrols are listed below. The following section lists some typical responsibilities of patrols.

Patrol Responsibilities

<u>General items</u>

- Record gauge readings (hourly);
- Inspect fences on the riverside of the levee frequently to make sure they are free from debris. If debris does collect along the fence, it must be cleared immediately or the fence must be cut to free the debris and decrease the possibility of damage to the levee.

- Verify that all necessary access roads and ramps along the levee are usable or will be satisfactorily conditioned.
- Take photographs of all significant issues (use date/time stamp feature on the camera, when possible).

Levees

- Look for sandboils or unusual wet areas landward of the landside toe;
- Look for slides or sloughing in levee side slopes;
- Look for wave wash or scouring of the riverside levee slope;
- Look for low areas in levee crown;
- Monitor relief wells (flowing/non-flowing);
- Check flap/sluice gates for proper closure; and
- Check gap closures (stoplog/sandbag, etc).

Floodwalls

- Look for saturated areas or sandboils landward of the floodwall;
- Look for settlement (movement) of the floodwall;
- Look for bank caving that may affect the structural stability of the floodwall;
- Inspect toe drain risers (discharging/non-discharging);
- Inspect the landside of floodwall for any leakage, especially around the monolith joints;
- Inspect for wet areas, soft areas, seeps, and sink holes landward of the toe of the floodwall; and
- Check gap closures (stoplog/sandbag, etc).

Pump Stations

- Verify proper ventilation (e.g., fans, vents) of the pumping plant to prevent overheating of pump motors.
- Look for sink holes or wet areas around the perimeter of the pumping plant, and/or settlement of the pump house. All of these conditions could potentially be the result of separation in the conduits. If separation is suspected, pumps and motors should be shut down until an engineering review can be conducted to analyze the condition.
- Verify that assigned operators are on duty 24 hours daily.

Equipment for Patrols

- Portable radio or cell phone;
- Watch;
- Log book;
- Patrolling instructions;
- Plan of action for patrolling;
- Plans of flood control project;
- Operation and Maintenance Manual for the project;
- Weather gear;
- Flashlights;
- Record Log;
- Life jackets;

- Probing rod;
- Short wooden stakes;
- 40 feet of one-half inch (½") nylon safety line to connect team members;
- Camera;
- Field boots; and
- Hard hats.

Safety/Security Precautions

Members of the patrol team should walk side-by-side with one person on the waterside of the levee near the surface, one at the top of the levee, and one on the landside toe of the levee. The team should move slowly enough to enable the member closest to the water to probe below the surface with a rod in order to discover any erosion that may be taking place. The person closest to the water should be wearing a safety line.

The person walking closest to the water should be especially observant of floating objects. The limbs and roots of a floating tree that have been uprooted can extend above the water surface and strike anyone walking along the edge of the water. To increase the chance of identifying floating objects, it is best to walk upstream when patrolling the waterside of the levee.

When patrolling floodwalls, the patrol should not attempt to walk along the top of the wall, but rather concentrate on potential problem areas on the landside (inside) of the wall. Where the wall is more than five feet above the landside ground level, it is recommended that observation points be selected approximately every 100 yards, and ladders should be used to observe the waterside of the floodwall.

Each person on the patrol should be thoroughly familiar with the community evacuation plan and signals. If evacuation is necessary, the patrolling organization should move to a predetermined location and keep the team intact. When returning to the levees and floodwalls, physical conditions may be considerably different from those observed prior to the evacuation, especially if the levee was overtopped. If overtopping occurs during nightfall, it is recommended that the patrols not resume until daylight, though there may be cases where this recommendation cannot be followed.

Patrols should also be watchful for anyone that seems out of place, or any activity that seems suspicious. Some individuals, terrorists or otherwise, may try to take advantage of already dangerous situations on levees or floodwalls. Any suspicious activities observed by the patrol should be reported immediately to the local law enforcement agency, State and local fusion centers, or the FBI.

General Maintenance Activities

Once the initial inspection has been completed, levee personnel should consider addressing any pressing maintenance issues before the river rises further. Emergency maintenance activities are no substitute for normal annual maintenance, and many of the activities listed below should not wait until high water conditions.

- Drainage structures are generally subject to inundation at lower stages than most other features of the flood control project. Therefore, any potential maintenance problems should be identified and corrected as quickly as possible before the water rises. All flap gates that are in critical or questionable condition should be manually checked and repaired as needed. Sluice gates should be inspected before the outlet end of the structure becomes submerged, and any trash, debris, or other potential obstruction present should be removed. If, for any reason, the gate system on a drainage structure fails to operate and cannot be repaired because of high water, immediate consideration should be given to blocking the structure opening by other means. If stream stages permit, the outlet end of the structure should be blocked using timber, metal plates, tarps, sandbags, or other means. If efforts to plug the outlet structure fail, immediate action should be taken to build a sandbag or earth ring around the inlet structure. While the primary concern in blocking the structures is to prevent high stages of the river from flowing into protected areas, emergency closures should be such that they can be readily removed after the river recedes.

- Immediate attention should be given to the grade line of each levee section or profile by comparison of existing grades with those shown in ‘as built’ record drawings. Fill any holes, gullies, and washes in the levee crown, embankments, and landside berms with compacted fill material if possible, or otherwise fill them with sandbags.

- Examine all drainage ditches on the landside of the levee and remove any obstructions. Be prepared to construct seepage drainage ditches, but not until actual seepage appears. Excavation of ditches near the levee or in the long berm area is hazardous and should not be undertaken except under direct supervision of appropriate personnel.

- Repair all levee settlement or depressions that have been worn down below levee grade. Materials used to fill holes and depressions should be obtained from distant sources (not adjacent to a levee system) unless it has been determined that borrowing in areas adjacent to the levee will not adversely affect its stability or the control of underseepage. Avoid taking material for these repairs from the area adjacent to the levee, particularly in the area of the seepage berm, except under direct supervision of appropriate personnel. The fill material should be compacted and protected from wave wash and other erosion as necessary.

Interaction with the public

The patrol team may encounter observers on the levees or at the floodwalls. If there are many observers, it is recommended that an additional person be assigned to each patrol team to act as a safety officer. The patrol team, however, is not responsible to order observers off the levees and floodwalls. It is recommended that each team carry and distribute instruction cards describing the community evacuation plan in order to inform observers of the potential danger.

Phase II: Full Response Activities

Continuing Activities

- Patrol continuously, 24 hours per day, 7 days per week (as the situation requires), especially if there are ponding areas during high water.
- Ensure all of the closures and gates are in place, and all maintenance is complete as described in Phase I: Preliminary Response Activities.
- Remove padlocks from access gates to facilitate patrols;
- Monitor inventory of flood fighting equipment, materials, and supplies as they are used;
- Keep the public informed of the current situation through the media, if warranted;
- Repair any erosion and seepage problems identified by patrols as quickly as possible;
- Ensure competent pumping station operators are on duty whenever it appears that an operation is imminent during flooding events, even when station operation has been automated. Operators should thoroughly understand the manner in which the pumping station was designed to operate and be capable of manual operation should automated equipment or sensors fail.
- Use of portable pumps may be needed to pump water over the levee if water is ponding in undesirable areas or is rising too quickly in ponding areas.
- Monitor debris basins and trashracks for sediment and accumulated debris; and
- Remove debris from trashracks at pumping stations periodically when the station is in operation. As debris and sediment continue to be deposited in the basin, debris loads will substantially block racks, and sediment deposits will block the entrance to the basin, forcing the flow against the sides. Any large accumulation of debris on racks or flow directed on the sides of basins will cause local erosion and scour. Levees and concrete structures that are part of the debris basin facility will need to be closely monitored to ensure optimal performance.

Evacuation Plan Activation

Levee personnel should be ready to evacuate the area. Consider the following points:

- Coordinate evacuation with police, fire department, and first responders immediately;
- Follow the predetermined routes; and
- Meet in predetermined locations and immediately confirm the safety of all levee personnel.

Volunteer Assistance

If it becomes necessary to recruit volunteers during the flood fight, there are a number of steps that can be taken to organize their support.

- Identify primary and alternate assembly areas with adequate parking;
- Arrange transportation, subsistence, and shelter for the labor force, as appropriate;

- Contact media to request that volunteers report to the designated assembly area, bringing flashlights, work gloves, rain gear, shovels, etc.
- Maintain a sign-in roster at assembly area to account for volunteers and personnel (name, home telephone number, address, work group assignment, etc).
- Identify staging areas away from the work site but as close to the flood fight locations as possible, and with clear access to roads. Separate areas in the staging site should be established for:

    - Sandbag filling;
    - Carrying and loading;
    - Materials stockpiles;
    - Rest and breaks; and
    - First aid.

- Establish an emergency operations center to oversee the flood fight operations and for interagency coordination. This operations center should be staffed 24 hours daily until the situation is resolved. Consider equipping the emergency operations center with:

    - Radios and telephones for communication;
    - Television and/or radio to monitor weather and river forecasts;
    - Emergency generator in case of power outages;
    - Flashlights;
    - Administrative supplies;
    - Levee operations and maintenance manuals;
    - Emergency preparedness plans;
    - Past flood reports / after action reports;
    - State and local maps, utility, flood plain, and levee maps; and
    - Telephone books, rosters list, and a directory listing numbers for railroad / highway departments (needed when closing access), local contractors, Red Cross, Salvation Army, hospitals, police, fire departments, State and local emergency operations centers, and other critical numbers.

- Establish traffic patterns that will be used to move sandbags from the staging area to the work site. If conditions permit, one-way traffic patterns should be established on the levee system if trucks are going to be used to transport the filled sandbags.
- Be certain that the people laying sandbags are well supervised by a trained individual.

Phase III: Post-Response Activities

Once the water has subsided, the area should be returned to the pre-flood condition by taking the following measures:

- Reopen any sluice gates that were closed once the water on the river side has receded to three inches (3”) below the pond level on the protected side.
- Open all closure structures and properly store all components;

- Remove and properly dispose of all temporary protection measures (e.g., sandbags and material placed during temporary levee raises).
- Take an inventory of all remaining flood fight equipment, sandbags, plastic, and other supplies. Repair or replace damaged equipment, and restock supplies such as sandbags or plastic in preparation for the next flood event.
- Salvage any materials and supplies (e.g., wood from flashboards);
- Return all borrowed equipment;
- Identify whether remaining materials can be reused within the community;
- Inspect the entire flood control work, noting locations of damage and the extent of damage at each location.
- Meet with key personnel, volunteer representatives, and community partners soon after the event to debrief, share remaining concerns, and discuss lessons learned during the event.
- Revise local emergency preparedness plans to account for lessons learned and changes to recommended procedures.
- Document the event: keep a map record of the levee, indicating areas that were in distress at the time of the flooding. This is useful for making repairs or improvements, and for use as a guide to focus attention on these areas during the next flood event.
- Locate and keep records of the flood's high water marks for future planning; keep these records along with any rainfall and river data you may have gathered.
- Make repairs to the levee as soon as possible in preparation for a future flood incident; and
- Initiate actions to provide permanent flood protection measures if the existing system relies heavily on temporary solutions during emergencies.