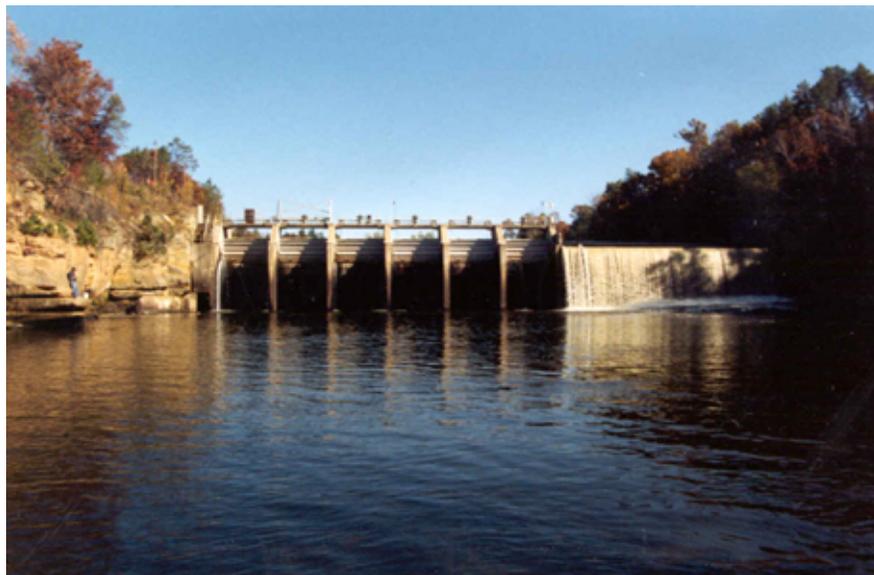


A GUIDE TO WRITING EMERGENCY ACTION PLANS



**Prepared by the Wisconsin Department of
Natural Resources**

Dam Safety/Floodplain Management



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This guidance was created by the Department of Natural Resources for the benefit and convenience of dam owners. Because of differences in the location, size, construction and downstream development of each dam, the dam owner may wish to consult his or her own risk manager and/or engineering consultant if modifications are considered necessary to the attached template.

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This document is available in PDF format at:

<http://dnr.wi.gov/topic/Dams/documents.html>

General

There are over 3,500 dams in the State of Wisconsin. Many of these dams have the potential to cause the loss of life and considerable property damage if they were to fail. Although a majority of dam owners are confident in the both structural integrity of their dam and operating procedures in place, events such as the heavy rains of August 2007 and June 2008 have shown that even the best maintained and operated dams can experience emergencies and threaten downstream properties.

The best method of avoiding an emergency response is proper operation, maintenance and inspection. Emergency Action Plans (EAP) cannot be a replacement for proper maintenance or remedial construction. However, a carefully considered and implemented EAP is a major positive step a dam owner can take to protect downstream lives and property, protect his/her investment and reduce potential liability.

Requirements for Emergency Action Plans

Under Chapter NR 333, Wisconsin Administrative Code, *Dam Design and Construction*, owners of large dams are required to develop an Emergency Action Plan (EAP) for each dam they own. An EAP is a formal document that identifies potential emergency conditions at a dam and prescribes procedures to be followed to reduce the likelihood of the loss of life and minimize property damage. The EAP must be developed in conjunction with the local community and emergency management agency and then be submitted to DNR Dam Safety staff for review and approval.

The purpose of an EAP is to provide the owner/operator of a dam, particularly a high hazard dam with a clear plan of action when any emergency arises. An emergency in terms of dam operation is identified as any condition which:

- develops unexpectedly;
- endangers the structural integrity of the dam; and
- could result in the dam's failure producing downstream flooding, requiring immediate action.

A well written EAP will identify the various parties involved in responding to a dam emergency, outline each party's responsibilities and tasks and lay out the appropriate lines of communication. An EAP should also outline levels of response based on the severity of the emergency.

Ch. NR 333.07(3)(c), Wisconsin Administrative Code lists the required components of an EAP. The section states:

(c) An adequate emergency action plan shall be prepared for the area downstream from the dam in consultation with the local unit of government and concurred in by the division of emergency government. An adequate emergency action plan shall include, but is not limited to, the following information:

- 1. A notification flow chart identifying involved agencies, other dam owners both upstream and downstream and their phone numbers.*
- 2. Emergency operation procedures.*
- 3. An inundation map of the hydraulic shadow on a scale of 1" = 2000' or less that extends downstream to an elevation within one foot of the dam nonexistent profile.*
- 4. Procedures for notification of all property owners affected by a dam failure and a list of their names, addresses and phone numbers.*

Each EAP must be tailored to site specific conditions, the requirements of the owner, agency or organization that operates or regulates the use of the dam and to the emergency response organizations that will implement the EAP. Once the draft EAP is written, it must be sent to the State Dam Safety Engineer and DNR Regional Water Management Engineer responsible for the county in which the dam is located for review and approval. Contact information for DNR Regional Water Management Engineers can be found in Appendix A of the EAP or at:

<http://dnr.wi.gov/topic/dams/regionalContacts.html>.

Guidebook Explained

The purpose of the Guidebook is to provide a dam owner with a simple standard process for writing an EAP. The planning process is broken down into a series of steps. Each step includes an explanation of the documents or actions required and why they are required. The step also includes a checklist to ensure that all required items are completed. A template EAP can be found in Appendix A and includes the various forms needed. It is recommended that the writer of an EAP review the entire Guidebook and

EAP template before starting. A dam owner may have much of the needed information on hand and may only need to transfer the information to the appropriate forms. Another source of information and assistance is the local emergency management official. A list of the suggested questions a dam owner should ask the local emergency manager can be found in Appendix A of the EAP.

Developing an effective EAP requires communication and coordination between various groups such as local elected officials, emergency managers, local law enforcement, state and federal regulators and the public. During the planning process, a dam owner may need to hold one or more coordination meetings to determine responsibilities during an emergency and to ensure concurrence on the plan.

The EAP planning process does not end once the EAP is written, approved and distributed to the involved participants. Part of the EAP planning process is an annual review of the document. All EAPs must be reviewed and updated annually to ensure that the individuals and agencies who agreed to participate in the response process still accept to tasks and responsibilities outlined in the document and to ensure that all contact information listed is accurate.

Using Your Emergency Action Plan

A dam owner can limit the need to activate an EAP through proper maintenance or remedial construction. However, if an emergency does arise at a dam the following suggestions may make an EAP easier to use.

- Have pages be single sided for ease in copying or replacement.
- Place the EAP in a three-ring binder for durable field use.
- Laminate important pages or place them in plastic sleeves.
- Use different colored paper for important pages or different sections.
- Use “hot buttons” divider tabs at the top to quickly access important sections during an emergency.
- Use side divider tabs for major sections for use during training, annual reviews, and updating.

- Use headers and footers to identify each sheet with dam name in case sheets get separated.
- Number each copy of the final EAP and maintain a record of the person who received each numbered copy to help assure all official holders receive future updates and revisions.

For more information on writing an EAP or for assistance in writing an EAP, please contact:

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Copies of *A Guide to Writing Emergency Action Plans* and the *Emergency Action Plan* template can be downloaded in PDF format from:
<http://dnr.wi.gov/topic/Dams/documents.html>.

An EAP is usually developed by following the steps listed below.

Emergency Action Plan Steps

- Step 1.** Locate and utilize or estimate a hydraulic shadow map which clearly depicts the areas flooded by a dam failure (hydraulic shadow).
- Step 2.** Identify those situations or events that could trigger an emergency condition and require action.
- Step 3.** Evaluate the condition and level of emergency for the various triggering events or situations.
- Step 4.** Identify all jurisdictions, agencies, groups and individuals who will be involved in an EAP.
- Step 5.** Identify primary and auxiliary communications systems, both internal (between persons at the dam) and external (between dam personnel and outside entities).
- Step 6.** List and prioritize the order of notification for all persons and entities involved in the notification process, and draft a *Notification Flowchart*.
- Step 7.** Develop a list of resources available to respond to an emergency including location in relation to dam.
- Step 8.** Develop a draft Emergency Action Plan.
- Step 9.** Hold one or more coordination meetings with all jurisdictions, agencies, groups and individuals who will be involved in implementing the EAP or who are on the *Notification Lists* to receive their review and comments for the draft EAP.
- Step 10.** Make any necessary revisions, obtain the necessary signatures for plan approval/concurrence, and distribute the EAP to those who have responsibilities under the plan.
- Step 11.** Set up process for post incident review, annual review, testing based on the county hazard mitigation plan and revision of the EAP as well as personnel training.

Step 1. Locate and utilize or estimate a hydraulic shadow map which clearly depicts the areas flooded by a dam failure (hydraulic shadow).

A map depicting the area affected by a dam failure (hydraulic shadow) is needed in order to determine who must be notified and/or evacuated in an emergency. The mapping should clearly identify residences, businesses, storage facilities, bridges, downstream dams and other structures such as roads, power lines, sewer and water lines and other infrastructure that could be affected by the failure of the dam. The map should also show community boundaries.

A hydraulic shadow map can be estimated under certain circumstances. However, it is preferred that the map be developed using an engineering study. An engineering consultant should develop the hydraulic shadow map using the flow data found in the Flood Insurance Study (FIS) if one exists. Copies of the FIS are kept by communities and on the DNR website: <http://dnr.wi.gov/topic/floodplains/mapindex.html>. At minimum, the hydraulic shadow map must include the necessary cross sections, channel crossings, structure identification and flood wave travel times.

If the hydraulic shadow map is estimated, it should be done on a base map with contour lines such as a USGS quadrangle map or a detailed LiDAR map. The estimated hydraulic shadow map should be replaced with one based on an engineering study as soon as possible.

It is recommended that the hydraulic shadow map be of a size that can easily fit into a binder. If the map is larger than 11" x 17" then the sheets should be produced with match lines.

NOTE: The dam failure analysis is **not** public information and for security reasons should not be included in the EAP. Only the dam failure (hydraulic shadow) map, profiles and floodway data tables should be included in the EAP.

Step 1 Checklist

- Map scale of 1" = 2000'
- Note stating map is tied to FIS
- Cross sections
- Channel crossings
- Structure identification
- Flood wave travel times
- Map shows downstream development including infrastructure.
- Determine if hydraulic shadow crosses community or county boundary.
- Match lines for multi-sheet maps.

NOTE: The Dam Failure Analysis is **not** public information and for security reasons should not be included in the EAP. Only the dam failure (hydraulic shadow) map, profiles and floodway data tables should be included in the EAP.

Step 2. Identify those situations or events that could trigger an emergency condition and require action.

The situations or events that could trigger an emergency condition vary in type and complexity and from dam to dam. An emergency can be as simple as higher than normal water levels in the pool to sinkholes forming in the embankment or a gate failing. A dam owner or operator should be aware of all the various threats to a dam and be prepared to respond appropriately.

The *Guidance for Determining the Emergency Level* chart found on page 10 lists the typical emergency situations a dam owner in Wisconsin might face. Each emergency situation is then rated for the level of severity. The levels of severity are defined as:

- Level 1: Urgent; dam failure appears imminent or is in progress.
- Level 2: Potential dam failure situation, rapidly developing.
- Level 3: Non-emergency unusual event, slowly developing; high water.

Step 3. Evaluate the condition and level of emergency for the various triggering events or situations.

Once the emergency situation has been noted, the dam owner/operator will need to assess the situation to determine the needed level of response. An emergency situation such as a rapidly enlarging sinkhole would be defined as a Level 1 emergency requiring immediate evacuation of downstream structures and alerting downstream dams of the situation.

The *Level of Emergency Determination Chart* found on page 11 should be used in conjunction with the notification lists developed in Step 6. The chart and the lists can assist a dam owner or operator in determining the needed level of response and who should be notified of the emergency. The chart lays out the various steps in responding to an emergency dependent of the level of severity. It is important to note that the chart places the most severe emergency, Level 1 as the first column. It is recommended that this order be followed when placing documents in the EAP.

STEP 2 Checklist

- Review *Guidance for Determining the Emergency Level* chart including Note.
- Discuss *Guidance* chart with county/local Emergency Management officials
- Discuss *Guidance* chart with dam owner's engineering consultant to determine other events that could affect the dam's condition or trigger an emergency at the dam and to determine if the levels of severity are appropriate for the dam.
- If inundation area crosses community or county boundary, discuss *Guidance* chart with all other affected emergency managers.

STEP 3 Checklist

- Review *Level of Emergency Determination Chart*.
- Discuss *Emergency Chart* with county/local Emergency Management officials to determine if other steps are needed in the response process.
- Discuss *Emergency Chart* with county/local Emergency Management officials to determine who is responsible for each step.
- If the hydraulic shadow map crosses community or county boundary, discuss *Emergency Chart* with all other affected emergency managers.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level *
Auxiliary/Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	3
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	1
	Spillway flow that is flooding people downstream	1
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	1
Seepage	New seepage areas in or near the dam	3
	New seepage areas with cloudy discharge	2
	Seepage with cloudy discharge; increasing flow rate	1
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	1
Embankment/ structural component cracking	New cracks in the embankment/structural component greater than ¼-inch wide without seepage	3
	Cracks in the embankment/structural component with seepage	2
Embankment/ structural component movement	Visual movement/slippage of the embankment slope/structural component	2
	Sudden or rapidly proceeding slides of the embankment slopes/structural component	1
Instruments	Instrumentation readings beyond predetermined values	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	1
Sabotage/ vandalism	Unauthorized operation of the dam	3
	Damage to dam or appurtenance with no impacts to the functioning of the dam	3
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	2
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	1

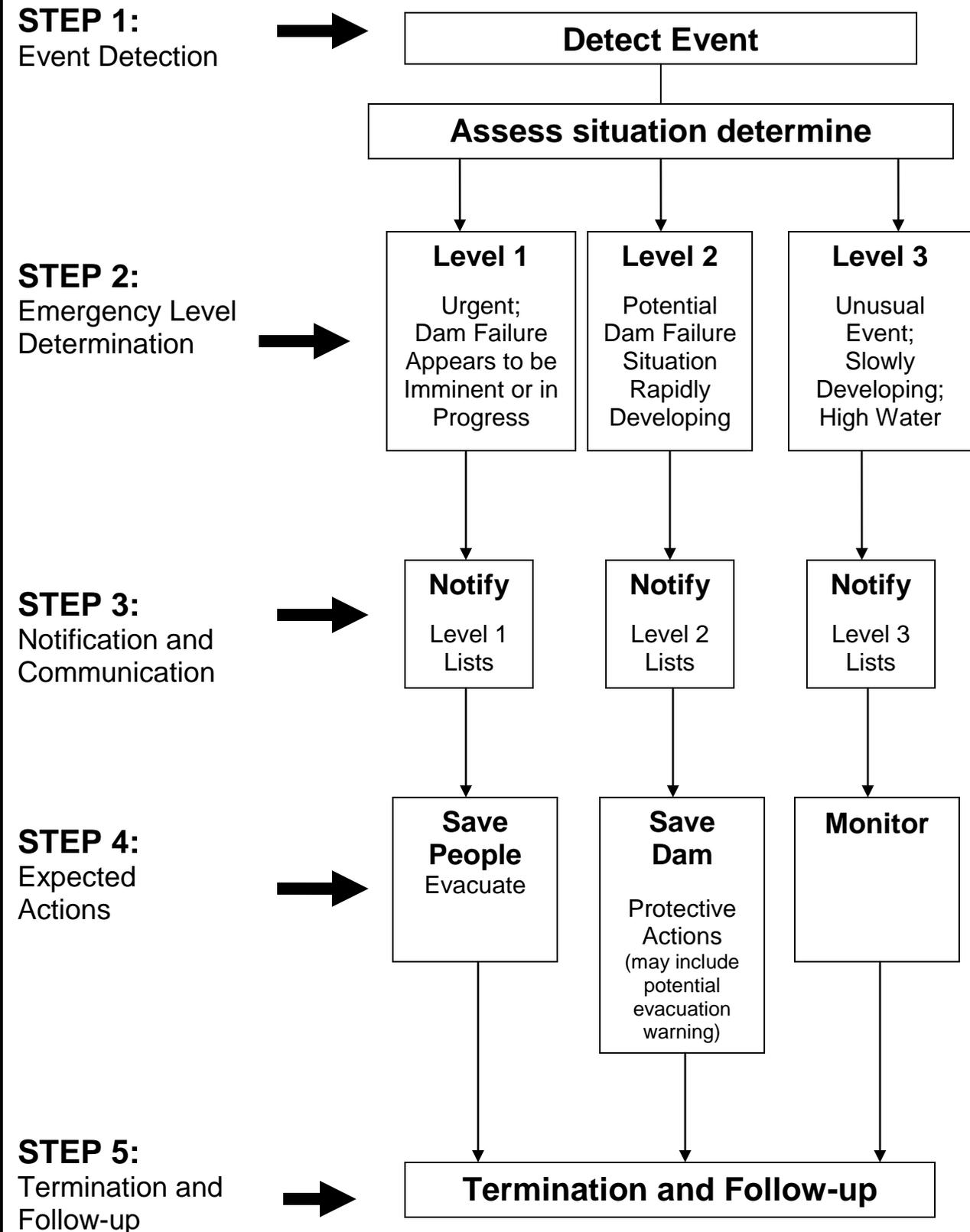
* Emergency Level 1: Urgent; dam failure appears imminent or is in progress

* Emergency Level 2: Potential dam failure situation, rapidly developing

* Emergency Level 3: Non-emergency unusual event, slowly developing; high water

NOTE: The *Guidance for Determining the Emergency Level* chart focuses primarily on the earthen components of a dam. Owners should discuss other possible failure scenarios with their consultant. Also, emergency levels may change based on site specific circumstances and discussions with the dam owner's consultant. Structural components may include concrete, wooden and metal components of a dam.

Level of Emergency Determination Chart



Step 4. Identify all jurisdictions, agencies, groups and individuals who will be involved in an EAP.

An effective EAP identifies everyone who would be affected by a dam emergency or involved in responding to a dam emergency. The hydraulic shadow map can be tool in determining who should be involved. The list of jurisdictions, agencies, groups and individuals who are involved will vary from dam to dam. However, certain agencies and groups will be involved for any dam. These include:

- Local and county emergency management officials;
- Local law enforcement (sheriff/police chief);
- Fire department;
- Downstream communities (chief elected official)
- Critical facilities such as hospitals, nursing homes, schools;
- Critical facilities such as sewage treatment plants, government buildings, roads, bridges, railroads; and
- Local media outlets such as newspapers, radio or TV stations

It is important to coordinate with the emergency management official responsible for the community surrounding the dam as well as those downstream and upstream. Emergency management officials can be an excellent resource for identifying anyone who could be affected by an emergency.

A number of the contacts identified through this step will be the same as those needed to approve the EAP. The approval process is explained in Step 10 on page 30.

A chart for listing EAP contacts can be found on page 14. Contact information should include both an office and alternative telephone number. If an agency is included as a contact, the list should include the name of both a primary contact and an alternate contact. The contact information provided should be used only for responding to an emergency. A disclaimer stating “*This contact information is not to be released to the public and is not to be used for any purpose other than a dam emergency.*” should be placed on the contact list.

STEP 4 Checklist

- Develop list of potential involved jurisdictions, agencies, groups and individuals.
- Review hydraulic shadow map for other possible groups or individuals.
- Review list with local emergency management for completeness.
- Obtain contact name and information for all listed jurisdictions, agencies, groups and individuals.
- Obtain name of alternative contact if needed.
- Determine those contacts who will be required to approve the EAP.
- Disclaimer for contact information.

Agency/Organization Notification List for Notification Flowchart

Agency/Organization	Principal contact	Address	Office telephone #	Alternate telephone #	Email Address

Intentionally Blank

Step 5. Identify primary and auxiliary communications systems, both internal (between persons at the dam) and external (between dam personnel and outside entities).

Communication at dams can be simple or complex depending on the type and location of the dam. A large dam may have several operators on-site at one time requiring the installation or use of internal communication systems such as telephones or radios. Dams may also be located near each other requiring the operators be able to easily talk to each other.

Whatever the size of the dam the dam owner/operator needs to be able to communicate with others at the dam and with outside entities during a dam emergency. As part of the EAP, the dam owner or operator should identify the primary method (equipment) used for communication both internally and externally during an emergency. An auxiliary or back-up method of communication should also be identified to be used if the primary method is unavailable due to weather, damage or other unforeseen circumstances.

The dam owner/operator should also review the existing communication plan used during an emergency. The plan should include who is to be contacted first, how the dam owner/operator will maintain contact with local emergency managers and who is responsible for maintaining contact through out the emergency. The plan may also identify who is the point of contact for any media inquiries. The communication plan should be put in writing and may be included as an appendix in the EAP.

Once the methods of communication have been identified, contact should be made with the local emergency manager to ensure coordination with overall emergency communication systems. The local emergency manager might also have suggestions on ways of improving the existing communication plan.

It is recommended that a *Communication Documentation Chart* be used during an emergency to document communication both internally and externally. A *Communication Documentation Chart* can show who was contacted at what time. It can also document how contact was made and what information was provided. A sample *Communication Documentation Chart* can be found in Appendix B of the EAP.

STEP 5 Checklist

- Review internal communication equipment for functionality and condition.
- Review external communication equipment for functionality and condition.
- Determine what alternative methods of communication are available if primary system fails.
- Discuss communication equipment used with local emergency manager.
- Discuss communication plan used with local emergency manager.
- Develop *Communication Documentation Chart*.

Step 6. List and prioritize the order of notification for all persons and entities involved in the notification process, and draft *Notification Flowchart*.

The purpose of the notification lists and the *Notification Flowchart* is to ensure that the appropriate people are notified of a dam emergency at the correct time. The response to an emergency will be more effective if clear lines of communication are established and maintained.

The notification lists should contain contact information for all persons and entities involved in the emergency response process as well as those affected by an emergency. The lists should include contact information for all affected communities, emergency management agencies, law enforcement and other first responders, residents, businesses and critical facilities such as hospitals and schools. The lists should also include contact information for any affected infrastructure such as dams, sewer and water lines, gas lines and energy companies. It is important to remember that dam emergencies have upstream as well as downstream effects. Also, a note should be made on the list of any individual who might require special assistance in the case of an emergency.

Different level emergencies may require contacting some or all of the names listed on the notification list. It is recommended that the dam owner coordinate with local emergency management to determine who should be contacted depending on the level of emergency. Example notification lists based on the level of emergency can be found on pages 20 – 21.

The first call in any emergency is always to the local law enforcement agency. A *Notification Flowchart* outlines who should be called next and who is responsible for those calls. The example *Notification Flowchart* found as an attachment to this document shows a typical telephone call tree.

The *Notification Flowchart* can be made larger or smaller as required. However, the boxes marked with an asterisk must be included with the information shown. A blank *Notification Flow Chart* has been included as an attachment in the template EAP found in Appendix A. The boxes in the blank Flowchart have been sized to fit address labels such as Avery 5160.

STEP 6 Checklist

- Review hydraulic shadow map for properties potentially affected by an emergency.
- Contact community for ownership information for affected properties.
- Coordinate with local emergency management for other sources of contact information.
- Include contact information for upstream properties and facilities if affected by an emergency.
- Develop draft *Notification Flowchart* for review under Step 9.
- Develop draft notification lists based on emergency level for review under Step 9.
- Determine any special evacuation needs such as individuals with disabilities or businesses storing hazardous materials.

Example Level of Emergency 1 Notification List Page ___ of ___

#	Name	Address	Telephone #	Critical Facility (Y/N)
1	Jane Smith, Sheriff	123 E. Main Street, Damton	608/928-9584	N
2	Al Cotton, Co Emg Mang	855 5 th Street, Charlesville	608/267-1234	N
3	Anna Wright, Mayor	125 E. Main Street, Damton	608/928-6677	N
4	Ed Torland, Fire Chief	123 E. Main Street, Damton	608/928-9585	N
5	John Andersen, Director	Shady Acres Rest Home 16 River Road, Damton	608/928-1414	Y
6	Mr./Mrs. Robert Elds	13 N River Road, Damton	608/928-2313	N
7	John Spotter, Operator	Downstream Dam 878 Streamside Road, Whitby	608/267-8829	N
8	Robin Shaw, Owner	Suite 1 The Bird's Nest 425 W. Main Street, Damton	608/928-6529	N
9	William Bell, Occupant	Suite 2 Bell's Accounting 425 W. Main Street, Damton	608/928-9282	N
10	Michelle Yang, Owner	The Boutique 427 W. Main Street, Damton	608/928-6823	N
11	Bertram Yost (Haz Mat)	Bert's Gas Station 425 W. 1 st Street, Damton	608/928-3683	N
12	Emily Johnson, Director	Damton Hospital 500 W 1 st Street, Damton	608/928-4510	Y
13	Ms. Ellen Jantz (wheelchair)	5 S. River Road, Damton	608/928-0034	N
14	Mr. Henry Popper	7 S. River Road, Damton	608/928-1441	N
15	Ms. Edna Christhof, Manager	Happy Days Mobile Home Park 19 S. River Road, Damton 25 MH pads (15 seasonal)	608/928-8666	N

Example Level of Emergency 2 Notification List Page 1 of 1

#	Name	Address	Telephone #	Critical Facility (Y/N)
1	Jane Smith, Sheriff	123 Main Street, Damton	608/928-9584	N
2	Al Cotton, Co Emg Mang	855 5 th Street, Charlesville	608/267-1234	N
3	Anna Wright, Mayor	125 Main Street, Damton	608/928-6677	N
4	Ed Torland, Fire Chief	123 Main Street, Damton	608/928-9585	N
5	John Andersen, Manager	Shady Acres Rest Home 16 River Road, Damton	608/928-1414	Y
6	Mr./Mrs. Robert Elds	13 River Road, Damton	608/928-2313	N
7	John Spotter, Operator	Downstream Dam 878 Streamside Road, Whitby	608/267-8829	N

Example Level of Emergency 3 Notification List Page 1 of 1

#	Name	Address	Telephone #	Critical Facility (Y/N)
1	Jane Smith, Sheriff	123 Main Street, Damton	608/928-9584	N
2	Al Cotton, Co Emg Mang	855 5 th Street, Charles	608/267-1234	N
3	Anna Wright, Mayor	125 Main Street, Damton	608/928-6677	N

Step 7. Develop a list of resources available to respond to a dam emergency including location in relation to dam.

It is not feasible for dam owners and operators to have all possible resources needed to respond to a dam emergency available on-site. Heavy equipment such as backhoes, bulldozers or dump trucks are more easily rented or borrowed. While smaller items such as pumps or siphons could be stored at the dam, the cause for use is so infrequent as to make this impractical. Therefore, it is important for a dam owner or operator to develop a list of resources needed to respond to a dam emergency, determine who has access to the needed resources and to know where they are located.

The types of resources needed to respond to a dam emergency depend of the size of the dam and the type of emergency. A very small dam with a shallow pool is unlikely to need a diver. However, all dams would need access to heavy equipment along with sand and gravel. It is recommended that consideration be given to all possible dam emergencies when developing the list of resources.

The *Available Resources Chart* example found on page 24 lists the typical resources a dam owner or operator might need. The list should include the type or quantity of equipment or material needed along with the name, address and telephone number of the supplier. An alternative method of contacting all resource suppliers should be considered to ensure access after normal business hours. A blank *Available Resources Chart* is included in the template EAP in Appendix A of this document. Please note that two address labels such as Avery 5160 can fit in the space provided on the *Chart*.

A map showing the location of all needed resources should be included in the EAP. A simple location map could be a county road map with the type of resource and the supplier's name, address and contact noted. An available resources map can be used to determine alternative transportation routes if roads or bridges have been closed due to high water or other obstructions to traffic.

STEP 7 Checklist

- Review list of possible emergencies found in Step 2.
- Determine what resources are needed to respond to an emergency.
- Determine what resources are maintained at the dam.
- Describe where resources at dam are kept.
- Determine what resources are needed from outside sources.
- Develop contact list including name, address and telephone number for both primary and secondary sources for resources.
- Obtain alternative contact information.
- Develop resource location map. Include alternative routes and secondary sources in case transportation routes are blocked.
- Discuss types of resources needed with dam owner's engineering consultant.

Available Resources Chart

Heavy equipment service and rental	Sand and gravel supply	Ready-mix concrete supply
(Type/quantity) (Company Name) (Company Location) (Telephone #)	(Type/quantity) (Company Name) (Company Location) (Telephone #)	(Type/quantity) (Company Name) (Company Location) (Telephone #)
Pumps/Siphons	Diving Contractor	Sand Bags
(Type/quantity) (Company Name) (Company Location) (Telephone #)	(Type/quantity) (Company Name) (Company Location) (Telephone #)	(Type/quantity) (Company Name) (Company Location) (Telephone #)
Additional Resources	Additional Resources	Additional Resources

Step 8. Develop a draft Emergency Action Plan.

An EAP should contain basic information on who is the owner/operator of the dam, a brief description of the dam and the area at risk, contact information for all parties involved in responding to a dam emergency or at risk from an emergency and the location of all needed resources. The well written EAP will provide a dam owner/operator with the information needed to ensure the safety of the surrounding community as well as limit his/her liability in a dam emergency.

At minimum, an EAP should contain the following sections:

- Cover Sheet/Dam Location
- Approval/Concurrence Page
- Purpose and Intent
- Description of the Dam
- Level of Emergency Determination Chart
- Emergency Notification Flowchart
- Hazard Area Map/Hydraulic Shadow Map
- List of Affected Structures/Individuals
- List of Resources
- Map of Resources
- Reentry and Recovery
- After Action Review
- Training, Testing and Annual Review
- Appendices
 - Supporting Narrative and Documentation
 - IOM
 - Dam plan and section
 - Dam Failure Analysis Profiles
 - Emergency Communication Plan
 - Glossary of Terms

The level of detail provided in each section will be dependent on the dam and the surrounding community.

A template EAP with blank forms can be found in Appendix A of this document. The template EAP contains all the required elements and is can be modified to meet the needs of each dam. A PDF format copy of the template EAP can be found at:

<http://dnr.wi.gov/topic/Dams/documents.html>. The template and the associated forms can be either printed and filled in by hand or completed on a computer with all unneeded text deleted.

The information gathered in Steps 1 – 7 and 11 can be used to write the EAP and complete the needed forms. Some additional information is required and explained below.

- **Cover Sheet:** The purpose of the Cover Sheet is to provide a brief overview of the dam's name, location, owner and contact information. The Cover Sheet allows users to quickly know the who, what, where and how of the dam.
- **Dam Location Map:** The purpose of the dam location map is to ensure emergency responders know how to get to a dam. Many dams are located in rural areas or on private land without public road access. It is very important to provide visual as well as verbal descriptions of how the dam can be accessed.
- **Concurrence:** The purpose of the concurrence page is to ensure that everyone who has a defined responsibility in the EAP agrees to accept the responsibility. Mandatory signers of the concurrence page are the dam owner, dam operator (if different from owner), local law enforcement, local emergency management, fire chief, the State Dam Safety Engineer and the DNR Regional Water Management Engineer. It is recommended that the chief elected officials of any affected communities also sign.
- **Dam Description:** A dam's description is based on the type, size, and components of the dam as well as its hazard rating. The hazard rating of a dam can be obtained by contacting the DNR Regional Water Management Engineer (see Appendix A of the EAP.)
- **After Action Review:** After every dam emergency, the response process should be reviewed to determine what went right and what could be improved. Needed changes must be agreed upon by the signers of the EAP and then made to the Plan. Updated copies of the EAP must then be distributed to all holders.

STEP 8 Checklist

- Review forms in template EAP.
- Transfer information gathered in Steps 1 – 7 onto the appropriate forms.
- Create needed maps.
- Contact DNR Regional Water Management Engineer for Dam Hazard Rating if not known (see Appendix A of the EAP).
- Obtain information needed for text portion of EAP.
- Review Step 11 in *Guidebook* if questions arise concerning the after action review process.
- Discuss annual review process as well as training and exercise opportunities with local emergency manager.
- Print draft EAP and distribute for review and comment. The draft EAP must be clearly marked as a draft document by either using watermarks or by writing the word “DRAFT” on each page.

Step 9. Hold one or more coordination meetings with all jurisdictions, agencies, groups and individuals who will be involved in implementing the EAP or who are on the notification lists to receive their review and comments for the draft EAP.

An effective EAP is one which is written in coordination with other emergency response plans and has been reviewed and commented on by all those involved in responding to a dam emergency or are on the notification lists. The purpose of the review is to ensure that the proposed plan works and to have approval/concurrence from other involved parties.

Comments can be obtained by either providing a copy of the draft EAP to those involved or by having at least one coordination meeting. A coordination meeting may also need to be held with business owners and residents if any would be affected by a dam emergency.

During the coordination meeting draft copies of the EAP should be provided to the participants. The various roles and responsibilities should be reviewed and agreed upon. The *Notification Flow Chart* should be reviewed to determine if all appropriate parties are included, assigned tasks are accepted and all contact information is reviewed and verified.

The draft EAP should also be reviewed by the local and county emergency management staff to ensure the EAP does not conflict with any All Hazards Emergency Response/Operations Plans which have already been adopted. Emergency managers also have experience in responding to emergencies and may be able to provide information on what has worked in other emergency situations, the availability of resources or who should be included in the response plan. The DNR does not need to review the EAP until after all comments have been received and the recommended changes made (see Step 10).

STEP 9 Checklist

- Develop preliminary list of reviewers.
- Discuss review list with local emergency management for completeness.
- Hold one or more meetings with all jurisdictions, agencies, groups and individuals who will be involved in implementing the EAP or who are on the Notification Lists to receive their comments on the draft EAP.
- Determine who is responsible for notifying others on the notification lists.
- Verify all contact information.
- Verify any special evacuation needs such as individuals with disabilities or businesses storing hazardous materials.

Step 10. Make any necessary revisions, obtain the necessary signatures for plan approval/concurrence, and distribute the EAP to those who have responsibilities under the plan.

Once all comments and recommended changes have been received and agreed upon, the final EAP can be written. The EAP must then be sent to the mandatory signers for their concurrence and approving signature. All other responsible parties must also concur and provide an approving signature. A sample *Concurrence* sheet can be found on page 32.

The DNR does not need to be involved in the writing of the draft EAP. However, the final EAP must be sent to the DNR Regional Water Management Engineer for final review prior to completing the *Concurrence* page. The DNR will review the final EAP and if it meets the requirements of the Dam Safety Program, then the State Dam Safety Engineer and the DNR Regional Water Management Engineer will sign the *Concurrence* page. The dam owner will be sent an approval letter conditioned on obtaining all other needed signatures.

Copies of the approved EAPs must be sent to the DNR Regional Water Management Engineer and all holders of the EAP. A list of anyone responsible for maintaining a copy of the EAP should be included in Appendix B of the EAP. The list should be updated and maintained as needed. A copy of the EAP must also be kept by dam owner and operator. If the dam has a structure on site, it is recommended that a copy of the EAP be posted in an easily accessible location.

The State Dam Safety Engineer must receive at minimum a paper copy of any approved EAP including completed *Concurrence* pages and all attachments. If possible, a copy of the EAP in PDF format on a CD should also be sent to the State Dam Safety Engineer at:

State Dam Safety Engineer
WI DNR WT/3
P. O. Box 7921
Madison, WI 53707

STEP 10 Checklist

- Make needed changes to EAP.
- Confirm changes with all signers of EAP
- Submit final EAP to DNR Regional Water Management Engineer for review and approval.
- Complete *Concurrence* page after receiving DNR approval signatures.
- Provide copies of approved EAP to all holders of the EAP.
- Post copy of EAP at dam structure.
- Provide copy of final EAP to the DNR Regional Water Management Engineer.
- Provide paper copy of final EAP to the State Dam Safety Engineer.
- Provide CD with PDF format of EAP to State Dam Safety Engineer if possible.

Concurrence

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1. _____
Signature (Dam Owner) *Date*

Printed name and title: _____

2. _____
Signature (Dam Operator) *Date*

Printed name and title: _____

3. _____
Signature (Local Law Enforcement) *Date*

Printed name and title: _____

4. _____
Signature (Local Emergency Management) *Date*

Printed name and title: _____

5. _____
Signature (Fire Chief) *Date*

Printed name and title: _____

6. _____
Signature (Director of Public Works) *Date*

Printed name and title: _____

7. _____
Approval Signature (State Dam Safety Engineer) *Date*

Printed name and title: _____

8. _____
Approval Signature (Regional Water Management Engineer) *Date*

Printed name and title: _____

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Step 11. Set up process for post incident review, annual review, testing based on the county hazard mitigation plan and revision of the EAP as well as personnel training.

The EAP planning process does not end once the EAP is written, approved and distributed to the involved participants. Every time an EAP is activated because of a dam emergency, it should be reviewed after the emergency is over to determine what went right and what could be improved. The after action review is an opportunity to fine tune the response process. Any changes to the EAP must be approved by the signers of the document and provided to them. Copies of any changes must also be sent to the State Dam Safety Engineer and the DNR Regional Water Management Engineer. Copies sent to the State Dam Safety Official should be in paper format at minimum and in PDF format if possible.

The opportunity to review an EAP after a dam emergency should be rare. Therefore, a dam owner should set up a process to review the EAP annually. The purpose of an annual review is to ensure that all contact information in the EAP is correct. At this time, the dam owner/operator ensures that all dam personnel are familiar with the EAP and their responsibilities. An annual EAP review may consist of discussing the document with the local emergency manager and confirming all contact information.

Changes of a minor nature such as updated contact information do not require an updated *Concurrence* page. However, the changes must be distributed to all those involved in responding to a dam emergency including the State Dam Safety Engineer and the DNR Regional Water Management Engineer. A *Receipt Confirmation* page should be used to document updates have been sent to all holders of the EAP. A blank *Receipt Confirmation Chart* can be found in Appendix B of the template EAP.

Along with an annual review of the EAP, dam owners/operators should meet with the local emergency manager every five (5) years to discuss what changes have been made to the All Hazards Emergency Response/ Operations Plan. Dam owners/operators should also work with local emergency management to determine what opportunities exist to conduct or participate in dam related EAP exercises.

STEP 11 Checklist

- Develop process for after action review including coordination with local emergency managers.
- Develop process for annual review including coordination with local emergency managers.
- Develop process for meeting with the local emergency manager at least once every five (5) years to discuss any changes to the local All Hazards Emergency Response/Operations Plan that might affect the EAP.
- Develop process for investigating opportunities for exercises.

APPENDICES

Emergency Action Plan Template
Glossary of Terms

GLOSSARY OF TERMS

Abutment – That part of the valley side or concrete walls against which the dam is constructed. An artificial abutment is sometimes constructed where there is no suitable natural abutment. Right and left abutments are those on respective sides of an observer when viewed looking downstream. The wall between a spillway or gate structure and the embankment can also be referred to as an abutment.

Alterations – Such changes in the design of the dam as may directly affect the integrity of the dam and thereby affect the safety of persons, property or natural resources.

Appurtenant Structures – The structures or machinery auxiliary to dams which are built to operate and maintain dams; such as outlet works, spillway, powerhouse, tunnels, etc.

Auxiliary Gate- A stand by or reserve gate used only when the normal means of water control is not available or at capacity.

Auxiliary Spillway (Emergency Spillway) - A secondary spillway designed to operate only during exceptionally large floods.

Boil - An upward disturbance in the surface layer of soil caused by water escaping under pressure from behind or under a water-retaining structure such as a dam or a levee. The boil may be accompanied by deposition of soil particles (usually silt) in the form of a ring (miniature volcano) around the area where the water escapes.

Breach – An opening or a breakthrough of a dam sometimes caused by rapid erosion of a section of earth embankment by water. Dams can be breached intentionally to render them incapable of impounding water.

Conduit - A closed channel to convey the discharge of water through or under a dam.

Core – A zone of material of low permeability in an embankment dam.

Corewall - A wall built of impervious material, usually of concrete or asphaltic concrete in the body of an embankment dam to prevent leakage.

Crest of Dam - The crown of an overflow section of the dam. In the United States, the term "crest of dam" is often used when "top of dam" is intended. To avoid confusion, the terms crest of spillway and top of dam should be used in referring to the overflow section and dam proper, respectively.

Cutoff Wall - A wall of impervious material (e.g., concrete, asphaltic concrete, steel sheet piling) built into the foundation to reduce seepage under the dam.

Dam – A barrier built for impounding or diverting the flow of water.

Dike (Levee) – An embankment, usually applied to embankments or structures built to protect land from flooding.

Drain, Layer or Blanket – A layer of pervious material in a dam to facilitate drainage. Includes toe drain, weephole and chimney drain.

Drawdown – The resultant lowering of water surface level due to release of water from the impoundment.

Embankment – Fill material, usually earth or rock, placed with sloping sides.

Embankment Dam (Earth Dam / Earthfill Dam) - Any dam constructed of excavated natural materials, usually earth or rock, placed with sloping sides.

Emergency Action Plan – A predetermined plan of action to be taken to reduce the potential for property damage and loss of lives.

Energy Dissipater - Any device constructed in a waterway to reduce or destroy the energy of fast-flowing water.

Engineer/Consultant – A licensed or registered engineer in a given state; offers experience and expertise in the design and inspection of dams.

Failure – An incident resulting in the uncontrolled release of water from a dam.

Foundation of Dam - The natural material on which the dam structure is placed.

Freeboard – The vertical distance between a stated water level and the top of a dam.

Gate or Valve – In general, a device in which a leaf or member is moved across the waterway to control or stop the flow.

Gravity Dam - A dam constructed of concrete and/or masonry that relies on its weight for stability.

Groin - That area along the contact (or intersection) of the face of a dam with the abutments.

Height of Dam - The vertical measurement expressed in feet as measured from the downstream toe of the dam at its lowest point to the elevation of the top of the dam.

Hydraulic Shadow Map - A map delineating the area that would be inundated in the event of a dam failure.

Impoundment – Water or wastewater held back by a dam.

Maintenance – The upkeep necessary for efficient operation of dams and their appurtenance works. It involves labor and materials, but is not to be confused with alterations or repairs.

Masonry Dam - Any dam constructed mainly of stone, brick, or concrete blocks that may or may not be joined with mortar. A dam having only a masonry facing should not be referred to as a masonry dam.

Ogee Spillway (Ogee Section) - An overflow weir in which in cross section the crest, downstream slope, and bucket have an "S" or ogee form of curve. The shape is intended to match the underside of the nappe at its upper extremities.

One percent/One Hundred Year (100-YEAR) Flood -The flood magnitude expected to be equaled or exceeded on the average of once in 100 years. It may also be expressed as an exceedance frequency with a 1% chance of being exceeded in any given year.

Operator – The owner, or an agent or employee of the owner.

Outlet – An opening through which water can freely discharge for a particular purpose from an impoundment.

Owner – Any person who owns, leases, controls, operates, maintains or manages a dam or impoundment.

Phreatic Surface – The upper surface of saturation in an embankment.

Piping – The progressive development of internal erosion by seepage, appearing downstream as a hole or seam discharging water that contains soil particles.

Plunge Pool – A natural or sometimes artificially created pool that dissipates the energy of free-falling water. The pool is located at a safe distance downstream of the structure from which water is being released.

Primary Spillway (Principal Spillway) - The principal or first used spillway during flood flows.

Repair – To essentially restore a dam to its approved design condition.

Riprap – A layer of large stones, broken rock or precast blocks placed in a random fashion on the upstream slope of an embankment dam, on a reservoir shore, or on the side of a channel as a protection against wave and ice action.

Scarp - The nearly vertical, exposed earth surface created at the upper edge of a slide or a breached area along the upstream slope of an earthen embankment.

Seepage - The movement of water that may take place through the dam, its foundations, or its abutments.

Slide - The movement of a mass of earth fill down a slope. In embankments and abutments, this involves the separation of a portion of the slope from the surrounding material.

Slump Area – A portion of earth embankment which moves downslope, sometimes suddenly, often with cracks developing.

Spillway - A structure over or through which flood flows are discharged. If the flow is controlled by gates, it is considered a controlled spillway; if the elevation of the spillway crest is the only control, it is considered an uncontrolled spillway.

Spillway Channel - A channel conveying water from the spillway crest to the river downstream.

Stilling Basin – A basin constructed to dissipate the energy of fast-flowing water, eg. from a spillway or bottom outlet, and to protect the river bed from erosion.

Stoplogs – Logs or timbers, steel or concrete beams placed on top of each other with their ends held in guides on each side of a channel or conduit.

Storage - The retention of water or delay in runoff either by planned operation, as in a reservoir, or by temporarily filling the overflow areas, as in the progression of a flood crest through a natural stream channel.

Tailwater Level - The level of water in the discharge channel immediately downstream of the dam.

Toe of Dam - The junction of the downstream face of a dam with the ground surface. Also referred to as the downstream toe. For an embankment dam, the junction of the upstream face with the ground surface is called the upstream toe.

Toe of Embankment – The junction of the face of the dam with the ground surface.

Top of Dam - The elevation of the uppermost surface of a dam, usually a road or walkway, excluding parapet wall, railings, etc.

Trash Rack – A structure of metal or concrete bars located in the waterway at an intake to prevent the entry of floating or submerged debris.

Valve - In general, a device fitted to a pipeline or orifice in which the closure member is either rotated or moved transversely or longitudinally in the waterway so as to control or stop the flow.

Weir - A low dam or wall built across a stream to raise the upstream water level. Termed fixed-crest weir when uncontrolled. A structure built across a stream or channel for the purpose of measuring flow. Sometimes described as a measuring weir or gauging weir. Types of weirs include broadcrested weirs, sharpcrested weirs, ogee weirs, and V-notched weirs.