

Session 15

Course Title: Floodplain Management

Session 15: What are Hazards?

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Time: 75 minutes

Objectives: (PowerPoint slide 15-1)

At the end of the session, students should be able to:

- 15.1 Discuss hazards in the context of risk,
 - 15.2 Define terms related to flood hazard and correctly use hazard terminology.
 - 15.3 Prepare a general flood hazard assessment.
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Scope

This session begins a six-session module that discusses hazards, risks, and the current and future human development impacts on these issues. Session 15 teaches basic hazard terminology and gives students the opportunity to use this terminology during in-class discussion and the homework assignment. Students learn to identify flood hazards and to differentiate among hazards to the natural system and those that are hazards to human development. The concept of hazard probability is discussed and related to the positive and negative impacts to the natural system. The Instructor leads a discussion of the components of a typical flood hazard assessment.

There are two homework assignments. In the first assignment, students will work individually to expand upon the Glossary that they received in the last session. In the second homework assignment, students will work together in teams to prepare their own flood hazard assessment.

Readings

Required Student Readings

Deyle, R.E., S.P. French, R.B. Olshansky, and R.G. Patterson. 1998. "Hazard Assessment: The Factual Basis for Planning and Mitigation." in R.J. Burby (ed.)

Cooperating with Nature. Confronting Natural Hazards with Land-Use Planning for Sustainable Communities. Washington, D.C.: Joseph Henry Press.

Federal Emergency Management Agency. 2001. *Understanding Your Risks. Identifying Hazards and Estimating Losses. State and Local Mitigation Planning How-to Guide.* FEMA 386-2. August. STEP ONE. Identify hazards; STEP TWO. Flood hazard profiles; STEP THREE. Flood hazard asset inventory; STEP FOUR. Flood hazard loss estimation.

Mileti, D.S. 1999. "Chapter 3. Losses, Costs, and Impacts." In *Disasters by Design. A Reassessment of Natural Hazards in the United States.* Washington, D.C.: Joseph Henry Press.

Instructors should build on the materials identified in the **References** section at the end of this session. Further student readings may be selected from these references.

Instructor Readings

Deyle, R.E., S.P. French, R.B. Olshansky, and R.G. Patterson. 1998. "Hazard Assessment: The Factual Basis for Planning and Mitigation." in R.J. Burby (ed.) *Cooperating with Nature. Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.* Washington, D.C.: Joseph Henry Press.

Federal Emergency Management Agency. May 1995. *Guide to Flood Insurance Rate Maps - For understanding how to read and use a FEMA Flood Insurance Rate Map.* FEMA-258. Washington, D.C.

Federal Emergency Management Agency. August 2001. *Answers to Questions About the National Flood Insurance Program.* FEMA-387. Washington, D.C.

Federal Emergency Management Agency. August, 2001a. *Understanding Your Risks. Identifying Hazards and Estimating Losses. State and Local Mitigation Planning How-to Guide.* FEMA 386-2.

Federal Emergency Management Agency. September 2002. *Getting Started. Building Support for Mitigation Planning. State and Local Mitigation Planning How-to Guide.* FEMA 386-1.

Federal Insurance Administration. 1998. *Managing Development through the NFIP. A FEMA home study course, now available as a reference guide.* FEMA IA-9

L.R. Johnston Associates. June 1992. *Floodplain Management in the United States: An Assessment Report. Volume 2: Full Report.* FIA-18. Prepared for: The Federal Interagency Floodplain Management Task Force.

Mileti, D.S. 1999. "Chapter 3. Losses, Costs, and Impacts." In *Disasters by Design. A Reassessment of Natural Hazards in the United States*. Washington, D.C.: Joseph Henry Press.

Schwab, J., K.C. Topping, C.C. Eadie, R.E. Deyle, and R.A. Smith. 1998. Chapter 7. "Hazard Identification and Risk Assessment." in *Planning for Post-Disaster Recovery and Reconstruction*. Planning Advisory Service Report No. 483/484. Washington, D.C.: American Planning Association.

White, G.F. 1974. Chap. 1. "Natural hazards research: concepts, methods, and policy implications." in: White, G.F. (ed.) *NATURAL HAZARDS. Local, National Global*. New York: Oxford University Press.

General Requirements

Make copies of Handout 15H-1 found at the conclusion of this session to distribute when the flood hazard assessment topic is presented. Handout 15H-1 presents a generic format of a basic flood hazard assessment and will be used as a transition to Session 16, What is Risk? It is also part of the Homework assignment.

Handout 15H-2 is the **Instructor's Guide** that includes the type of information applicable to each section. The instructor's version may be handed out and if so, copies need to be made.

Make sure there is time at the end of the session for questions about the homework assignment.

Remarks

Why is an understanding of risk and risk reduction planning important to our understanding of floodplains? In many instances, risks can be reduced, managed, and manipulated. An understanding of the processes involved in the hazards of floodplain development will enable us to

- profile these hazards,
- reduce vulnerabilities,
- increase the capabilities of the environment, and
- ultimately to manage risk.

Objective 15. 1 **Discuss hazards in the context of risk (PowerPoint slide 15-2)**

I. Introducing the concept of Risk

- A. Risk is a function of a hazard and vulnerabilities, and to understand risk you must understand the relationship between these two concepts.
- B. In this session, you will profile a flood hazard. In subsequent sessions, you will address other components of risk, (vulnerability, exposure, and capabilities) and investigate risk reduction measures.
- C. However, before we begin this search, it is important to understand that a flood does not represent a risk unless something you value is exposed to the flood and that “something” is referred to as vulnerability. The risk is also conditioned by your capability to reduce the risk. This relationship between the hazard, vulnerability, (including exposures) and capability determines the risk.
 - 1. For instance a big rotten tree in the forest can be hazard, but it is only a risk to you if you step under it—you become exposed to the hazard and you are vulnerable (not wearing a hardhat for instance).
 - 2. This risk is greater if your capability to get out the way is compromised if you are in a wheel chair or have fallen asleep.
- D. The field of floodplain management and emergency management uses three very broad and interrelated risk models or approaches.
 - 1. Risk as a function of the **frequency** and **impact** of the hazard.
 - 2. Risk as a function of the relationship among the **hazards**, **vulnerabilities**, and **capabilities**.
 - 3. Risk as a visual depiction as the result of a **Geographic Information System** (GIS) analysis.
- E. This session will address what is a hazard and how to profile flood hazards. Subsequent sessions will address the other conditions that define risk—vulnerability, exposure, and capability.

Objective 15.2: Define terms related to flood hazard and correctly use hazard terminology.

I. Introduction (PowerPoint slide 15-3)

- A. *“It was a dark and stormy night...”*
 - 1. Some of you may recognize this phrase. It did not originate with Snoopy in the Peanuts cartoon however; it is the opening line of an early 19th century novel. The story begins:

“It was a dark and stormy night; the rain fell in torrents—except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets (for it is in London that our scene lies),

rattling along the housetops, and fiercely agitating the scanty flame of the lamps that struggled against the darkness."

—Edward George Bulwer-Lytton, *Paul Clifford* (1830)

- B. Briefly ask a few students to identify any hazards the author is describing. (The instructor can circle or highlight the hazards as the students suggest them.)
 - 1. Instructor can remark that there may be some confusion over the student suggestions.

II General Concepts

- A. Each profession has terms and concepts that are specific to that profession and by extension to the general public. Our profession is no different.
 - 1. Therefore, to avoid confusion during our discussions and exercises let us work towards common definitions that you will see as you practice floodplain management. We will build on the existing literature to define these terms.
 - 2. We will spend a good part of this lesson on semantics because is important for us to develop a common language of communication as we move through this session.
 - 3. Our goal is for you to be able to effectively communicate with federal and state representatives, scientists, practitioners at the state and local levels of government, and most importantly your constituents—the general public.
- B. Let us establish common concepts dealing with floods. Agreement on these concepts is important as we discuss floodplain management in a riverine system. (PowerPoint slide 15-4)
 - 1. Floods occur in natural systems, even when no human development exists in the floodplain.
 - 2. Floods in natural systems do not present a hazard to humans and are typically beneficial to natural systems.

III. Hazards

- A. Hazards are conditions that have the potential to threaten human injury, property, and the things that human's value. Hazards are the result of three main factors (PowerPoint slide 15-5):
 - 1. Natural conditions such as weather and seismic activity.
 - 2. Human interference with natural processes such as a levee that displaces the natural flow of floodwaters.
 - 3. Human activity and its products such as homes on a floodplain.

IV. Definitions by Organizations and Experts

- A. The Federal Emergency Management Agency (FEMA, 2002, p. a-2) uses the following definitions -**(PowerPoint slide 15-6)**. Earlier in this session we saw a slightly different definition for some of these terms, so be aware that FEMA often uses somewhat different definitions for the same terms.
1. A *hazard* is "**a source of potential danger or adverse condition.**"
 2. A *hazard event* is "**a specific occurrence of a particular type of hazard**" which in our case of flooding.
 3. *Hazard identification* is "**the process of identifying hazards that threaten an area.**"
- B. The American Planning Association (Schwab et al., 1998, p. 326) uses the following definitions **(PowerPoint slide 15 -7)**.
1. A **hazard** is "an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss."
 2. **Hazard identification** is "the process of defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations or areas affected."
- C. Deyle et al. (1998) uses the following definitions **(PowerPoint slide 15-8 and 15-9)**.
1. "**Hazard refers to an extreme natural event that poses risks to human settlements.**" (p. 121) The likelihood of a hazard is usually calculated on an annual basis. Example: the 1% chance flood is a flood that has a 1% chance of occurring or being exceeded in any given year.
 2. **Hazard identification** "defines the magnitudes (intensities) and associated probabilities (likelihood's) of natural hazard that may pose threats to human interests in specific geographic areas." (p. 21)
 3. Stated a little differently (p. 124) **hazard identification** "is the process of estimating the geographic extent of the hazard, its intensity, and its probability of occurrence."
 4. **Intensity** is the "damage-generating attributes of a hazard." (p. 124). Example: the Saffir/Simpson scale characterizes hurricanes; Intensity of a flood: water depth and velocity.

- D. White (1974, p. 4) (**PowerPoint slide 15 –10**) defines a **natural hazard** as "an interaction of people and nature governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system."
1. “**Extreme events** which exceed the normal capacity of the human system to reflect, absorb, or buffer them are inherent in hazards. An extreme event was taken to be any event in a geophysical system displaying relatively high variance from the mean."
- E. Finally, a flood hazard is "the potential for inundation that involves risk to life, health, property, and natural floodplain values." (L.R. Johnston Associates 1992, p. C-3) (**PowerPoint slide 15 –10**).
- F. As we have been discussing the many ways people define a hazard, have you have been critically thinking about what they present? It is very important that you always analyze what people say, that you think about what they mean.
1. Did you notice the common ideas or concepts that these definitions share? What are they?
 - a. The definitions for hazard, hazard event, hazard identification, and flood hazard include related concepts.
 - b. A hazard may be connected to human activity.
 - c. Hazards are extreme events.
 - d. Hazards generally pose a risk of damage, loss, or harm to people and/or their property.
- H. The legal definition used by the National Flood Insurance Program (NFIP) (**PowerPoint slide 15 – 11**) provides the NFIP’s regulatory basis for non-critical development. It defines a floodplain as the area adjacent to a watercourse that has a 1% chance of becoming wet in any single year. This is also referred to as the 100-year floodplain. For critical development it is the over bank area that has a .2 percent chance of becoming wet in one year or the 500 year floodplain
- V. Identifying and Displaying Hazards (**PowerPoint slide 15 – 12**). A.
- We usually represent hazards on maps, such as the **Flood Insurance Rate Maps (FIRM)**, which show the 1% chance floodplain (100-year floodplain), the floodway, and the depth of inundation.
1. These maps show areas where development should be protected from flooding, and can also be used to identify **vulnerable** properties and existing structures that should be relocated or purchased.

B. Flood Insurance Studies (studies used to develop the maps) will give additional information on the characteristics of the flood that is useful to local planners and decision-makers.

1. Suggest that students do a Google search to uncover many different Flood Insurance Studies --
(<http://www.lib.ndsu.nodak.edu/govdocs/flood/fiscass80.html>)

C. Hazard identification gives the public and local officials information on flooding and can be a very effective tool for land use planning and management. We all know that awareness is the first step toward initiating solutions (guiding new development with techniques such as zoning, building codes to reduce risk, and addressing flooding of existing structures through acquisition, relocation, flood proofing,) and saving lives (flood forecasts and warning, emergency evacuation, roads that flood and must be closed—most deaths in flooding occur when people drive into floods).

VI. Flood Hazards—a brief overview

- A. In the beginning, many people thought that floods were simply random events that were unpredictable. Courts once agreed floods were “acts of god,” which was at one time a defense for those who might have even caused a flood to damage others. That legal defense no longer exists.
- B. In fact, flooding is the most predictable of all natural hazards. Extreme wind, wildfire, and earthquake are much more unforeseen.
 1. Flood event data such as flow, depth, velocity, and frequency of occurrence began to be collected, and it became apparent that flood events could be predicted.
- C. Between the 1920’s and 1960’s, as flood mitigation programs were developed, it was necessary to have some kind of standard approach for designing structures and regulating development.
 1. Standards were developed for building flood control structures such as dams, levees, and channels.
 2. Zoning, building codes, regulations and other approaches were created to guide development to be less flood prone.
- D. The U.S. has adopted the **1% chance flood**.
 1. This concept tries to balance protecting the public from harm and the costs of the flood event. These costs include the destruction and the subsequent rebuilding efforts involved in the event as well as the cost of building to the regulatory standard.
 2. This concept is important because it defines when flood insurance is required and what triggers floodplain regulation.

- E. The floodplain management profession realized what they were describing was a flood with a 1% chance of occurring or being exceeded in any given year. Those professionals found citizens and officials had trouble relating to the concept of percent probability. In an attempt to simplify the term, they coined the phrase “**100 year flood**”, with the follow on explanation that this flood would occur on the average of once every 100 years. Many people assumed that if a 100-year flood occurred, they had 99 years before a similar event would occur.
1. What the profession knew, but was seldom explained and even less seldom understood was **probability theory**. First, our prediction might be based on stream gage records of far less than 100 years, often 10 to 30 years, meaning there was a great chance the predicted event reflected a period of abnormal flooding, and was not accurate. In addition, the “once every 100 year average” would only balance out only over perhaps thousands of years. As history has shown, the predicted 1% event can and has occurred more than once in the same year; has occurred four times in eight years on some major streams, etc. It is simply a predicted probability.

Notes

The following Glossary of flood and related terms is a handout that was given at the end of the previous session. It is reprinted here so the Instructor can review as needed before the discussion of flood hazard assessment. Power Points of especially relevant terms are provided.

BASE FLOOD is the flood having a 1-percent chance of being equaled or exceeded in any given year (one hundred-year flood) (Schwab et al., 1998).

FLOOD is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters, from unusual and rapid accumulation or runoff of surface waters from any source, or from mudflow (FEMA, 2001a). [notice how FEMA placed conditions on its definition, which omits smaller floods]

FLOOD INSURANCE RATE MAP (FIRM) This is the map used by nearly all 20,000 flood prone communities in the nation, which displays shaded areas in the community that are subject to flooding. Flood insurance rates are based on risk of the various areas shown on the map. In addition, most community’s regulations are tied to the different risk zones shown on that map. **(PowerPoint slide 15 – 13).**

FLOODPLAIN (Flood-prone area) is any land area susceptible to being inundated by water from any source (Schwab et al., 1998).

FLOODPLAIN MANAGEMENT is the operation of an overall program of corrective and preventive measures for reducing flood damage, including, but not limited to, emergency preparedness plans, flood control works, and floodplain management regulations (Schwab et al., 1998).

FLOODPLAIN MANAGEMENT MEASURES refers to an overall community program of corrective and preventive measures for reducing future flood damage. These measures take a variety of forms and generally include zoning, subdivision, or building requirements, and special-purpose floodplain ordinances (FEMA, 2001a).

ONE-HUNDRED-YEAR FLOOD is the flooding event that has a 1-percent chance of being equaled or exceeded in a particular location in any given year (Schwab et al., 1998).

REGULATORY FLOODWAY (**PowerPoint slide 15 –14 and 15.15**) is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (Schwab et al., 1998).

REGULATORY FLOODWAY is the stream channel plus that portion of the overbanks that must be kept free from encroachment in order to discharge the 1-percent-annual-chance flood without increasing flood levels by more than 1.0 foot (some states and many communities specify a smaller, [often zero] allowable increase) (FEMA, 2001a).

SPECIAL FLOOD HAZARD AREA is an area of land that would be inundated by a flood having a 1-percent chance of occurring in any given year (also referred to as the base flood or 100-year flood) (FEMA, 2001a).

SPECIAL FLOOD HAZARD AREA is land in the floodplain within a community subject to a 1-percent or greater chance of flooding in any given year (Schwab et al., 1998).

Student Homework Assignment #1 (**PowerPoint slide 15 –16**).

Using other sources, students should expand the Glossary to show different ranges of meaning of these terms. Each citation should include a complete citation to the source document. Copies of student glossaries can be reproduced or emailed to class members. Instructors can discuss in subsequent session some of the major differences among the definitions and how these differences may influence approaches to floodplain management.

Objective 15.3: Prepare a general flood hazard assessment

I. Purpose of Flood Hazard Assessment

- A. The purpose of a flood hazard assessment is to give citizens and local officials a clearer picture of the dangerous event they are facing and the vulnerability of the community. As a result, everyone is better prepared to develop a flood mitigation program and a floodplain management plan. When we discuss the characteristics of a flood, we think of the four elements of a hazard and add specific flood components.
1. A flood hazard assessment for your community will describe a flood event using the following parameters.
- B. It is helpful to view hazards as having four elements because it can help you develop a hazard profile or physical description of a hazard. This description helps you answer such basic questions as:
1. How big is it?
 2. How long will it last?
 3. How fast is it moving?
 4. Where will this hazard most likely occur?
- C. The four elements of a flood hazard (or any hazard) are
1. **severity:** magnitude (depth, velocity, quantity), duration (time period), and extent (coverage, area, expanse);
 2. **probability or occurrence interval:** frequency (annual, 1%. 0.2%), seasonality, and probability of re-occurrence;
 3. **location or distribution across space:** geographic location, spatial distribution, and presence on the landscape; and
 4. **countdown interval or speed of occurrence:** rapidity of commencement, warning time, and life cycle (flash flood, slow rise flooding, etc.).
- D. Hazards can be divided into primary and secondary hazards.
1. **Primary hazards** are those that are the initiating peril such as flooding or earthquakes.

2. **Secondary hazards** are those triggered by the primary hazards. Flooding can cause bank erosion, landslides, and even fires.

Notes for discussing the student homework assignment and reviewing the Flood Hazard Assessment Handout 15H-1

The following discussion describes how an instructor could prepare the class for their flood hazard assessment homework assignment.

Handout 15H-1 presents a **generic worksheet** for a basic flood hazard assessment. This worksheet will be used during the remainder of Session 15 and as a transition to Session 16.

Handout 15H-2 is the **Instructor's Guide** for 15H-1 that includes the type of information applicable to each section. Both Handouts are also provided in the following section for easier access for the Instructor.

To begin the **Student Homework #2** explanation, the instructor can follow the information in the Instructor's Guide, Handout 15H-2. The Instructor's Guide provides example answers to the hazard assessment. For example, the Instructor can ask students in the class to provide examples of each term in their generic worksheet. The Instructor could ask: "What are some socio-economic factors to consider when you are examining flood implications for a community?" An answer is provided in Handout 15H-2—land use, demographics, cultural resources, economic conditions, critical facilities, government buildings, transportation network, hazardous sites, infrastructure. The Instructor's Guide may, at the discretion of the instructor, be used solely by the Instructor or in class or handed out to the class.

**Handout H15-1. Generic format of a flood hazard assessment
Profiling the Hazard.**

A FLOOD HAZARD ASSESSMENT

I. Introduction

II. Community setting (baseline conditions)

- A. Physical
- B. Biological
- C. Socio-economic
- D. Institutional
- E. Capability of community to prepare for and respond to floods

III. The flood event

- A. Severity
 - 1. Magnitude
 - 2. Duration
 - 3. Extent
- B. Occurrence interval
 - 1. Frequency
 - 2. Probability
- C. Distribution across space
 - 1. Geographic location
 - 2. Presence on the landscape
- D. Speed of occurrence
 - 1. Rapidity of Commencement
 - 2. Life cycle

- IV. Consequences - Direct (primary) and indirect (secondary)**
 - A. Natural environment (the physical and biological elements)
 - B. Human-built environment (Land use, development, buildings, infrastructure, economy)
 - C. Social/political/organizational systems (poorer populations, government structure, government and non-government organizations)
 - V. The vulnerability of the community to flooding**
 - VI. Conclusions, summary, and estimation of risk**
 - VII. Bibliography**
 - VIII. Appendix**
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Notes and Homework Assignment #2 Instructions to Students

Title: Prepare a Basic Flood Hazard Assessment.

- I. State the homework parameters and expectations (**PowerPoint slide 15 – 17**). The Instructor should as much as possible divide the class into teams based on interests and assign an individual with a physical, biological, social, or economic background to each team. Tell students that as part of this exercise, it is important for them to start thinking of how they will be working with the range of professionals they will encounter outside the classroom.
 - A. Each team should consult the appropriate sources of information and collect what is needed for the Flood Hazard Assessment.
 - C. Assign the location for the flood hazard assessment.
 - 1. The Instructor should select a location as the place of interest for the Flood Hazard Assessment.
 - a. Choose a high school known to be in a floodplain or a small watershed in the community
 - 2. The Instructor should give an overview of the flooding problem.

- D. Tell students they are expected to complete the following sections of Handout 15H-1:
 - 1. Section I. Introduction
 - 2. Section II. Community setting (baseline conditions)
 - 3. Section III. The flood event
 - 4. Section IV. Consequences - Direct (primary) and indirect (secondary)
 - 5. Section V. Vulnerability of the community to flooding will be completed after the next class, Session 16
 - 6. Section VII. Conclusions, summary, and estimation of risk will be completed after the next class, Session 16.
 - 7. Students should start on Sections VII Bibliography and VII. Appendix. Both of these sections will be completed after the next class, Sessions 16.
- E. Tell students what is expected.
 - 1. Each team will make a class presentation of about 10-15 minutes on the information collected and provide a copy of the bibliography for fellow students.
- F. Tell students how they will be critiqued.
 - 1. The class will critique each presentation based on the types of information and data assembled and their applications and value to developing a Flood Hazard Assessment.
 - 2. It is up to each Instructor to determine grading options and discuss with students.
- F. Tell students when the assignment is due.
 - 1. Students have one week to complete the assignment. Reports will be made at the beginning of the next class.
- II. **Describe how students should collect information for the assessment.**
(Instructor's description can include the following information.)
 - A. As professionals, students should collect information and data for their flood hazard assessment from as many sources as possible.
 - 1. The generic format (Handout 15 H-1) distributed in class is one method of recording your flood event information.

2. What students will soon determine is that some sources are more reliable than others.
- B. Discuss methods of information gathering and sources of information students can use to complete the Flood Hazard Assessment assignment. (At the Instructor's discretion, he or she can place examples in the Reserve collection of the University's library.)
1. Search the Internet and visit the library as well as specific agencies and organizations for flood information.
 2. Visit county and municipal departments; the zoning office, public works, office of emergency preparedness, planning commission, river basin commissions, levee boards, and drainage districts.
- C. Discuss examples of **state sources of information**.
1. The coordinating office of the National Flood Insurance Program which is probably in the Dept. of Natural Resources or Emergency Management, the Department of Public Works, the Department of Transportation, the state climatologist, the State Hazard Mitigation Officer, state geological survey, the Office of Emergency Preparedness, the State Police, the National Guard, and the Governor's office.
- D. Discuss examples of **federal sources of information**.
1. The regional office of the Federal Emergency Management Agency, (FEMA), the District and Division offices of the U.S. Army Corps of Engineers, the state office of the U.S. Geological Survey, the regional and state offices of the Natural Resources Conservation Service, the National Weather Service, and the Federal Highway Administration.
- E. Discuss other sources of information and data.
1. University departments (engineering, geology, geography, landscape architecture, planning, sociology, or environmental), TV stations (they always seem to know where to set up their cameras for the best photos of floods), newspapers (like the TV stations, they know who to interview), the American Red Cross, and nonprofit organizations.

INSTRUCTOR'S GUIDE

Handout 15H-2. Generic format of a flood hazard assessment with examples Profiling the Hazard.

FLOOD HAZARD ASSESSMENT

I. Introduction (includes the following information)

- A. Project name and location (state, county, municipality, watershed)
- B. Overview of the flooding problem in at least a paragraph.
- C. Purpose of the Flood Hazard Assessment
 - 1. The purpose of a flood hazard assessment is to give citizens and local officials a clearer picture of the dangerous event they are facing and the vulnerability of the community.
- D. Description of each the sections

II. Community setting (baseline conditions)

Section II describes the community setting, that is, the physical, biological, socio-economic, institutional, and capability that characterize the study area. We call these parameters the baseline conditions. You may think of this section as describing the appearance of the landscape.

- A. Physical—geology, geomorphology, soils, climate, meteorology, hydrology, and floodplains.
- B. Biological—flora, fauna, and threatened and endangered species.
- C. Socio-economic—land use, demographics, cultural resources, economic conditions, critical facilities, government buildings, transportation network, hazardous sites, and infrastructure.
- D. Institutional—federal, state, and local programs and regulations including NFIP, zoning, subdivision regulations, building codes, and miscellaneous ordinances.
- E. Capability of community to prepare for and respond to floods. This includes the emergency response program and staff.

III. The flood event

Section III profiles the flood event by portraying the severity, occurrence interval, spatial extent, and speed of occurrence.

- A. Severity
 - 1. Magnitude - depth, velocity, quantity
 - 2. Duration - time period
 - 3. Extent - coverage, area, expanse
- B. Occurrence interval
 - 1. Frequency—annual, seasonal, monthly, daily, and meteorological phenomena (e.g., winter frontal passage, hurricane, summer thunderstorm).
 - 2. Probability—1% chance in a given year (100-year storm); 10% chance in a given year (10-year storm), etc.
- C. Distribution across space
 - 1. Geographic location—river valleys, dry lakebed, identifiable channel, and floodway.
 - 2. Presence on the landscape—seasonal, intermittent, or permanent.
- D. Speed of occurrence
 - 1. Rapidity of Commencement—slow build-up, flashy, or surge.
 - 2. Life cycle—quick rise and fall, slow rise and fall, and quick rise and slow fall.

IV. Consequences—Direct (primary) and Indirect (secondary)

Section IV describes the consequences of the flood on the elements that constitute a community. We develop this information by superimposing a flood event such as a 50-year flood onto the baseline conditions. This process allows you to interpret the direct (primary) and indirect (secondary) impacts on the elements in the community

The instructor should describe the consequences of flooding for each of the conditions described in Section II above: natural environment (the physical and biological elements); human-built environment (land use, development, buildings, infrastructure, economy, critical facilities); social/political/organizational systems (poorer populations, government structure, government and non-government organizations)

- A. Direct Effects

1. Direct effects are impacts that are caused by the action and occur at the same time and place (40 CFR 1508.8). These may also be called primary impacts and apply to both adverse and beneficial impacts.
2. Direct effects are caused immediately by the event itself, such as a bridge washing out during a flood (FEMA, 2001a, p. ix).

B. Indirect effects

1. Indirect effects are impacts that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). They may also be called secondary impacts and applies to both adverse and beneficial impacts.
2. Indirect effects usually involve interruptions in asset operations and community functions, also called functional use. For example, when a bridge is closed due to a flood, traffic is delayed or rerouted, which impacts individuals, businesses, and public services, like fire and police departments that depend on the bridge for transportation (FEMA, 2001a, p. ix).

V. The vulnerability of the community to flooding

Sections V and VI deal with vulnerability of the community to flooding and affords us the process for transitioning to the concept of risk. We will develop the concepts of risk and vulnerability in the next class (Session 16). This exercise serves as a transition to our discussion of risk.

VI. Conclusions, summary, and estimation of risk

- A. This section will be completed as part of Session 16.

VII. Bibliography

The Bibliography includes full citation to all documents and sources of information you used to prepare your Flood Hazard Assessment. Be sure to have complete citations so the reader can access the materials you used.

- A. This section contains any references used in the preparation of the worksheet.

VIII. Appendix

The Appendix provides supporting information and the analytical procedures you employed when preparing your report.

- A. The appendix presents raw data, tables, and information substantiating analysis fundamental to the conclusions. Here also are appropriate calculations developed as part of the report.
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References

Deyle, R.E., S.P. French, R.B. Olshansky, and R.G. Patterson. 1998. "Hazard Assessment: The Factual Basis for Planning and Mitigation." in R.J. Burby (ed.) *Cooperating with Nature. Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*. Washington, D.C.: Joseph Henry Press.

Federal Emergency Management Agency. May, 1995. *Guide to Flood Insurance Rate Maps - For understanding how to read and use a FEMA Flood Insurance Rate Map*. FEMA-258. Washington, D.C.

Federal Emergency Management Agency. August, 2001. *Answers to Questions About the National Flood Insurance Program*. FEMA-387. Washington, D.C.

Federal Emergency Management Agency. August, 2001a. *Understanding Your Risks. Identifying Hazards and Estimating Losses. State and Local Mitigation Planning How-to Guide*. FEMA 386-2.

Federal Emergency Management Agency. September, 2002. *Getting Started. Building Support for Mitigation Planning. State and Local Mitigation Planning How-to Guide*. FEMA 386-1.

Federal Insurance Administration. 1998. *Managing Development through the NFIP. A FEMA home study course, now available as a reference guide*. FEMA IA-9

L.R. Johnston Associates. June, 1992. *Floodplain Management in the United States: An Assessment Report. Volume 2: Full Report*. FIA-18. Prepared for: The Federal Interagency Floodplain Management Task Force.

Mileti, D.S. 1999. "Chapter 3. Losses, Costs, and Impacts." In *Disasters by Design. A Reassessment of Natural Hazards in the United States*. Washington, D.C.: Joseph Henry Press.

Schwab, J., K.C. Topping, C.C. Eadie, R.E. Deyle, and R.A. Smith. 1998. Chapter 7. "Hazard Identification and Risk Assessment." in *Planning for Post-Disaster Recovery and Reconstruction*. Planning Advisory Service Report No. 483/484. Washington, D.C.: American Planning Association.

White, G.F. 1974. Chap. 1. "Natural hazards research: concepts, methods, and policy implications." in: White, G.F. (ed.) *NATURAL HAZARDS. Local, National Global*. New York: Oxford University Press.

PowerPoint Figures in a separate file

- 15-1 FLOODPLAIN MANAGEMENT. What are Hazards?
- 15-2 FLOODPLAIN MANAGEMENT. Hazards in the context of risk.
- 15-3 FLOODPLAIN MANAGEMENT. Defining Hazards
- 15-4 FLOODPLAIN MANAGEMENT. Basic Concepts
- 15-5 FLOODPLAIN MANAGEMENT. What are Hazards?
- 15-6 FLOODPLAIN MANAGEMENT. Defining Hazard Terms
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- 15-17 FLOODPLAIN MANAGEMENT. Flood Hazard Assessment Exercise