Flood Risk Terminology for National Flood Risk Characterization Workshop

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Terminology in risk is messy. We need to specify the terms and their usage for our purpose. These are not universal but at least this provides points of reference and common understanding during this endeavor. The vocabulary of flood risk management (FRM) terms below should be kept in mind during presentations and discussions of this workshop. Part I contains terms adapted to the flood risk context while Part II has terms encountered in risk more general discussions.

The development of the vocabulary began with the glossary of terms in ER 1110-2-1156 and the draft levee safety Engineering Circular. Additionally, the Department of Homeland Security "Lexicon of Risk 2010" was consulted as was the "Attachment A: Vocabulary of Flood Risk Management Terms" from the draft report "Improving the U.S. Army Corps of Engineers' Contribution to Flood Risk Management" and the draft IWR report "Principles of Risk Analysis for Water Resources."

Part I.

1. **Flood Risk**. The likelihood and consequences that may arise from inundation by flood water. Flood risk is determined by the following components: flood load (magnitude and likelihood of the hazard); the performance or response of any flood defense system (e.g., levee system – if such is present) to the flood load; the exposure to flood water of the item(s) at risk that might be harmed by flood water (population, property, infrastructure, etc); the vulnerability of the items at risk to harm from flood water; and the resulting measure of the harm, i.e., consequences that result from the flooding event (number of fatalities, dollar economic damages, environmental impacts, etc.).
2. **Flood Risk Assessment**. A systematic, evidence-based approach to qualitatively and/or quantitatively describe one or more determinants or elements of flood risk for assets and people, and the expected effects of flood risk reduction actions on flood risk. Risk assessment includes explicit acknowledgment of the uncertainties in the risk.
3. **Flood Risk Communication**. The process by which flood risk assessment results are disseminated to floodplain occupants and agencies of government for their consideration in decision-making relating to floodplain location and use as well as the choice of actions to reduce flood risk and manage residual risk. More generally risk communication is the open, two-way exchange of information and opinion about hazards and risks leading to a better understanding of the risks and better risk management decisions.
4. **Flood Risk Management**. The mix of federal and non-federal government policies and programs that influence the decisions made by communities and individuals relating to floodplain location and their choice of actions to reduce flood risk and manage residual risk. The term also includes the decisions made by all levels of government and by individuals to implement actions to reduce flood hazard, exposure, and vulnerability as well as to increase resiliency. More generally risk management is the process of problem finding and initiating action to identify, evaluate, select, implement, monitor and modify actions taken to alter

levels of risk, as compared to taking no action. The purpose of risk management is to choose and prioritize work required to reduce risk.

5. **Residual Flood Risk**. The level of flood risk for people and assets located in a floodplain that remains after implementation of flood risk reduction actions. Residual risk includes "transformed risk." Residual risk is often defined as the risk beyond the "level-of-protection" provided by hazard reduction infrastructure. However, level of protection refers only to the return frequency of a specific flood elevation, and so does not include all of the determinants of residual risk.
6. **Transformed Flood Risk**. The change in the nature of flood risk for some area associated with the presence of hazard reduction infrastructure. For example, the presence of a levee system can result in a more sudden inundation of a floodplain location if the levee breaches (with or without overtopping), thus increasing the vulnerability of exposed populations in that location.
7. **Transferred Flood Risk**. A change in flood risk (or financial costs) in one location due to a floodplain location and use choice and/or implementation of a risk reduction action in another location. Transferred risk occurs when floodplain location and use and/or risk reduction actions result in: 1) financial costs for risk reduction actions paid by another entity, such as from general tax revenues of a higher level of government instead of by the floodplain occupants; 2) induced flood hazard in another location, and; 3) diminution of natural functions of floodplains that adversely affect the well-being of others (e.g.,. reduction in recreational fishing success).
8. **Flood Risk Management Strategies**. Actions that are intended to reduce the likelihood or the potential adverse consequences of a future flood. They include actions to reduce the hazard, reduce exposure, and reduce vulnerability, as outlined below.
    a. Reduce the Hazard. Reduce the likelihood of flood water inundating a location, for a given duration, through:
        i. New investments to increase upstream flood water storage (dams, wetlands and floodplain restoration, runoff controls for pervious surfaces) and to secure flowage easements,
        ii. New investments in channels, levee systems, walls, and culvert sizing to keep floodwater away from an area of the floodplain
        iii. Proper O&M, inspection for structural integrity, and rehabilitation of past investments
        iv. Temporary flood-fighting.
    b. Reduce Exposure to the Hazard. Reduce the potential for people and assets to come into direct contact with flood waters that inundate the floodplain through:
        i. Information programs intended to affect floodplain location and use decisions.
        ii. Regulation intended to direct and limit new floodplain land occupancy and use decisions.
        iii. Payments made to relocate assets and associated populations that are currently in the floodplain in order to change floodplain land settlement patterns and use.
        iv. Payments made by landowners (occupancy fees or mandatory insurance premiums) that can influence their floodplain occupancy and use choices
    c. Reduce Vulnerability to the Hazard. Reduce the likelihood that people and assets will realize adverse consequences from their exposure to the flood hazard through:

        i. Cost reimbursements, building codes, insurance premium adjustments to encourage or require flood proofing, building elevation, ring levees, etc.
        ii. Local emergency warning systems, evacuation plans and transportation equipment, and shelters combined with:
            1. Information programs to encourage individual preparedness planning, and
            2. Strategies for enforcing and executing mandatory evacuation, including evacuation assistance.

9. **Residual Flood Risk Management Actions**. Actions that increase the ability of people and assets to recover from floods and minimize the long term consequences of floods. These actions include:
    a. Planning and program design to assure rapid and effective execution of post disaster assistance programs, including:
        i. Post flood counseling
        ii. Rebuilding of public infrastructure
        iii. Emergency aid and recovery assistance.
    b. Increased availability and subsequent purchase of insurance (NFIP/ commercial, crop insurance) to assure larger and more immediate post flood payouts.
10. **Flood Resilience**. The ability to avoid, minimize, withstand, and recover from the adverse effects of a flood.
11. **Flood Risk Robustness**. The ability of a system (physical, social, cultural or economic) to continue to operate correctly across a wide range of flood conditions, with minimal harm, alteration or loss of functionality, and to fail gracefully outside of that range. The wider the range of conditions included, the more robust the system.
12. **Level-of-flood Protection**. A levee design concept that is founded on the principle of providing a high degree of assurance that the levee system will neither breach nor overtop when loaded with a specific recurrence interval flood. The recurrence interval of the flood for this design principle is then used as an expression of the performance of the levee system at the time of design. For the purposes of its use in levee safety documents, this terminology is restricted to applications when discussing design targets or design concepts; it is not to be used as a general expression of levee system performance.
13. **Incremental Risk for Levee Systems**. Incremental risk for levee systems arises when levee system flood defenses do not perform as planned. The flood risk for a leveed area attributed to the levee system in its existing condition is determined by subtracting the without breach flood risk from the flood risk with the levee performing in its existing condition (all failure modes and consequences assessed). As a manner of policy this difference is called the incremental flood risk due to the presence of the levee system. Note that for a floodplain that is non-leveed, there is no infrastructure present to impede the flood hazard from inundating the floodplain, so there is no incremental risk.
14. **Incremental Risk for Dams**. The flood risk to the pool area and downstream floodplain occupants that can be attributed to the presence of the dam should the dam breach prior or subsequent to overtopping, or undergo component malfunction or misoperation. The consequences typically are due to downstream inundation, but loss of the pool can result in significant consequences in the pool area upstream of the dam and loss of other project outputs.

15. **Incremental Consequences**. The consequences for a leveed area attributed to the levee system in its existing condition is determined by subtracting the without breach flood risk from the flood risk with the levee performing in its existing condition (all failure modes and consequences assessed). As a manner of policy this difference is called the incremental consequences due to the presence of the levee system. Note that for a floodplain that is non-leveed, there is no infrastructure present to impede the flood hazard from inundating the floodplain, so there are no incremental consequences. In incremental consequences for a dam are defined in a similar manner.

Part II

1. **Risk Characterization**. Risk characterization is the qualitative or quantitative description of the nature, magnitude and likelihood of the adverse effects associated with a hazard with and without a risk management action. A risk characterization often includes: one or more estimates of risk; risk descriptions; evaluations of risk management options; economic and other evaluations; estimates of changes in risk attributable to the management options.
2. **Uncertainty**. Used to describe any situations without sureness, whether or not described by a probability distribution. In the context of flood risk, uncertainty can be attributed to (i) inherent variability in natural properties and events such as inherent variability in annual peak flood flows, and (ii) incomplete knowledge of parameters, variables, quantities and the relationships between them and the values of interest.
3. **Acceptable Risk**. The level of risk at which, given costs and benefits associated with risk reduction measures, no action is deemed to be warranted at a given point in time (DHS)
4. **Broadly Acceptable Risk**. Risks generally regarded as insignificant and adequately controlled. The levels of risk characterizing this region are comparable to those that people regard as insignificant or trivial in their daily lives. They are typical of the risk from activities that are inherently not very hazardous or from hazardous activities that can be, and are, readily controlled to produce very low risks.
5. **Tolerable Risk**. Tolerable risks are: risks that society is willing to live with so as to secure certain benefits, risks that society does not regard as negligible (broadly acceptable) or something it might ignore, risks that society is confident are being properly managed by those responsible for creating or managing the risk, and risks that those responsible for creating or managing the risk keep under review and reduce and manage still further if and as practicable
6. **Unacceptable Risk**. A level of risk bearing or imposition that cannot be justified except under extraordinary circumstances.
7. **Exposure Assessment**. Exposure occurs when a susceptible asset comes in contact with a hazard. An exposure assessment, then, is the determination or estimation (which may be qualitative or quantitative) of the magnitude, frequency, or duration, and route of exposure.
8. **Individual Risk**. The increment of risk imposed on a particular individual by the existence of a hazardous facility. This increment of risk is an addition to the background risk to life, which the person would live with on a daily basis if the facility did not exist.
9. **Societal Risk**. The risk of widespread or large scale detriment from the realization of a defined risk, the implication being that the consequence would be on such a scale as to provoke a socio/political response, and/or that the risk (that is, the likelihood combined with the consequence) provokes public discussion and is effectively regulated by society as a

whole through its political processes and regulatory mechanisms. Such large risks are typically unevenly distributed, as are their attendant benefits.

10. **Safety**. Safety is thought of as the condition of being free from danger, risk, or injury. However, safety is not something that can be absolutely achieved or guaranteed. Instead safety is the condition to which risks are managed to acceptable levels. Therefore, safety is a subjective concept based on individual perceptions of risks and their tolerability
11. **Variability**. The distribution or spread of values within a natural "population" or data set. This array of possible values in a population is caused by the inherent randomness of natural or social systems. The values in the statistical population have some probability distribution, and only limited knowledge of the entire statistical population and the probability distribution may exist. Sometimes variability is classed as a type of uncertainty although generally it should not be confused or interchanged with uncertainty as defined above. Variability is the notion that there is a range of possible values that will occur and not the lack of knowledge about that range or the distribution of those values.
12. **Risk Identification**. The process of finding, recognizing, and describing potential risks.