PLANNING BULLETIN

US Army Corps of Engineers®

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Subject: Incorporating Life Safety into Flood and Costal Storm Risk Management Studies

Applicability: Guidance

1. References:

a. Engineer Regulation 1105-2-100, Planning Guidance Notebook (2000).
b. Engineer Regulation 1105-2-101, Risk Assessment for Flood Risk Management Studies (2017).
c.Engineer Regulation 1165-2-26, Implementation of Executive Order 11988 on Flood Plain Management (1984).
d. Engineer Regulation 1110-2-1156, Safety of Dams Policies and Procedures (2014).
e. Engineer Circular 1110-2-6074, Guidance for Emergency Action Plans, Incident Management and Reporting, and Inundation Maps for Dams and Levee Systems (2018).
f. Engineer Circular 1165-2-217 Civil Works Review Policy (2018)
g. Policy Guidance Letter 52, Floodplain Management Plans.
h. ECB 2019-03 Risk Informed Decision Making for Engineering Work During Planning Studies.
i. Planning Bulletin 2019-03, Further Clarification of USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Risk Management Measures.
j. Director's Policy Memorandum Civil Works Programs 2018-05, Improving Efficiency and Effectiveness in USACE Civil Works Project Delivery (Planning Phase and Planning Activities)
k. Memorandum for Commanders, Directors, and Chiefs of Separate Offices, HQUSACE, Subject: Release of Information to the Public, dated 18 November 2008.

2. Applicability. The Planning Bulletin applies to all flood and coastal storm risk management feasibility studies, including those conducted under the Continuing Authorities Program and studies conducted by non-federal interests under Section 203 of the Water Resources Development Act of 1986, as amended.

3. Background. Risks to human life are a fundamental component of all facets of flood and coastal storm risk management and must receive explicit consideration throughout the planning process. This Planning Bulletin provides information on the use of life safety in the planning process and augments, but does not supersede, the procedures in references 1a and 1b. In addition, project outputs, including life safety, will also inform design of new, or modifications to existing levees and dams, in accordance with the agency's policies on risk-informed design.

4. Study Considerations.

a. The federal objective to contribute to national economic development is not the only planning objective or matter to address in planning. Section 904 of the Water Resources

Development Act of 1986 (33 U.S.C. §2281) identifies additional matters to be addressed in planning, including the prevention of life loss. The inclusion of potential life loss requires consideration of several concepts that augment familiar flood and coastal storm risk management planning practices, such as human behaviors and societal (large scale that would result in a negative societal response) and individual (most vulnerable single individual or group) life risk. Factors that influence life loss include, but are not limited to, the depth and velocity of flooding, infrastructure performance, socio-economic characteristics of the population, warning systems, evacuation plans, emergency response, and other preparedness measures.

b. The Project Delivery Team (PDT) will identify potential risks to life safety in the problems, opportunities, or objectives, as appropriate, early in the study, the specifics of which will vary based on the conditions in the study area. Plan formulation and evaluation will also explicitly consider and incorporate risks to life safety into all flood and coastal storm risk management studies, which the PDT will document in the decision document. The PDT will use plan formulation strategies to specifically address the contributors of risk to life safety, including identifying measures deemed outside the federal project that reduce or manage life risk. Evaluation must consider whether and how measures and alternatives change the risk to life safety in the future, including increases to the potential for life loss, risk transformation, and risk transfer.

c. A Floodplain Management Plan (reference 1g) contains necessary components to manage flood risk over time, including measures identified during the study that fall outside the purview of the federal government to implement. This includes the emergency response, preparedness, and recovery actions necessary to manage existing and future risks to people, property, and the environment. Emergency action plans (EAPs) are a vital part of managing residual risk and should be included in the floodplain management plan in all recommendations where dams and levee systems are part of the study (See reference 1e for additional information on EAPs).

d. In accordance with existing policy, the non-federal partner is encouraged to develop the floodplain management plan during the feasibility study rather than waiting until construction of the project. Coordination with the entity in the local or state government responsible for evacuation planning and implementation is required.

e. The scope and detail of data collection and model assessment (analytic rigor) in the study are scalable, including assessments of the potential for life loss. The level of detail will depend on the decision being made, what is necessary to address uncertainty in the results, complexity of the problem, and cost of addressing the risks. Greater uncertainty, complexity, or cost may require greater analytic detail, whereas lower uncertainty, complexity, or cost may require less analytic rigor. Conversely, in some cases, high risks to life safety may warrant consideration of not waiting for more detailed assessments and proceeding with the study and implementation as quickly as possible. Additional information on risk assessments is found in Reference 1b.

5. Levee Systems and Dams. Studies that include existing and proposed levee systems and dams must take special care in evaluating the risk imposed by the infrastructure on the population downstream or in the leveed area. This risk is referred to as incremental risk or dam or levee risk in references 1d and Attachment A. The definition of a dam is in Reference 1d, and the definition of a levee system is in Attachment A.

a. One goal of planning studies that include an existing dam or existing levee systems is to achieve all four Tolerable Risk Guidelines (TRGs), as described in references 1d and Appendix A, through the formulation, recommendation, and implementation of cost effective plans that reduce the risk posed by the infrastructure. The PDT will include specific objectives regarding achieving TRGs when existing dams and levees are in the study area.

b. Like all planning objectives, the extent to which the TRGs objectives can be met will vary based on the conditions in the study area and the efficiency and effectiveness of measures that contribute towards meeting the objectives. At a minimum, one alternative that addresses TRG 1 and TRG 4 must be identified.

c. In cases where evaluation reveals the formulated alternatives do not reduce risk below the societal life risk line or individual life risk line, the PDT must describe what factors drive the remaining risk for the societal or individual life risk, whether revisions to the formulated alternatives can be made to lower the societal or individual life risk, or if additional formulation is required. Additional formulation includes the addition of measures or adding a previously unidentified plan to the array of formulated plans. The PDT must present the information at an in-progress review with the vertical team or at the next study milestone to gain vertical team concurrence on either carrying forward the modified or new alternative that addresses TRG 1 and 4 for additional evaluation or screening the alternative. In general, the additional formulation occurs between the Alternatives Milestone and the Tentatively Selected Plan Milestone.

d. If a study recommends a new or modifications to an existing dam or levee, a risk assessment on the tentatively selected plan is necessary to inform design of the levee or dam. Recommendations must also include the costs necessary to inform the design and implementation of the project, including those required in law for new dams (Section 1202 of the Water Resources Development Act of 1986, as amended (33 USC §2311) and Reference 1d).

e. Modifications to existing dams or levees that require new authorization for flood risk or incremental risk reasons will incorporate the relevant senior oversight group's (SOG) members in to the existing feasibility study review and milestone processes. Levee senior oversight group (LSOG) or dam senior oversight group (DSOG) members from the relevant disciplines will participate as members of the agency technical review team or vertical team, as appropriate, to assure the quality of the technical information and create vertical team alignment throughout the study process. Appropriate LSOG or DSOG members will be identified in the Review Plan, in coordination with the LSOG or DSOG Chair and Review Management Organization, as a part of the review process for existing levees and dams.

f. Planning leadership at all levels of the vertical team is responsible for the consideration and integration of levee or dam safety information into the study and the study recommendations. Coordination between Planning and the Safety Programs provides efficiencies in studies by making existing risk assessments and risk information available to PDTs. The planning leadership at the district, division, and headquarters must seek out dam or levee safety program participation from the start of the study for those studies involving existing dams or levees. For studies where the tentatively selected plan likely includes a new dam or levee, planning leadership will seek dam safety or levee safety participation in the study no later than between the alternatives and tentatively selected plan milestones. The level of participation will vary based on whether the study is of an existing or new dam or levee and the specifics of the study; however, the Levee Safety Officer (LSO) or Dam Safety Officer (DSO) participation in milestone meetings, key in-progress reviews, and the study itself is mandatory. The LSO or DSO can participate by proxy or by coordinating comments with the planning leader or decision maker in advance of the meeting. For studies where milestone decision making is delegated (see Reference 1j), the LSO or DSO at headquarters' participation requirement is met by the Major Subordinate Command (MSC) LSO/DSO. The district LSO/DSO must be a part of the district Quality Control team for the study and identified as such in the Review Plan. The identified levee or dam safety personnel will also be listed as PDT members in the Review Plan. See References 1f for additional information.

g. The PDT is responsible for ensuring the district LSO/DSO and Dam Safety Program Manager (DSPM) and/or Levee Safety Program Manager (LSPM) are appropriately engaged in the study process. The LSO/DSO and LSPM/DSPM will assign appropriate levee or dam safety personnel to the team in order to ensure the quality of the risk assessment used in the study and to facilitate transparent decision making in the study. In addition, the LSO/DSO and LSPM/DSPM will assign a trained facilitator endorsed by the Risk Management Center to lead the risk assessment. If a trained facilitator is not available within the District or MSC, the Risk Management Center will help identify an appropriate resource.

h. The district, MSC, and Headquarters LSO/DSO and LSPM/DSPM will also invite the planning leadership in the district, MSC, and/or headquarters to participate in safety program activities for levees or dams currently part of an ongoing study to assure the most recent available safety risk information is available and used for the study.

i. References 1d, 1e, and 1kl provide information and processes related to sharing and the release of information related to dams and levees and must be followed.

6. The point of contact for this Planning Bulletin is Maria Wegner, (202) 731-9962.

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Attachment A Tolerable Risk Guidelines

1. This appendix provides definitions used by the USACE Levee Safety Program as well as information on Tolerable Risk Guidelines (TRGs) and how the TRGs are used with respect to the Levee Safety Program.

a. The term “levee risk,” sometimes referred to as “incremental risk,” is used to refer to the risk associated with the levee system itself. Flooding in a leveed area may occur from four scenarios, referred to as “inundation scenarios.” These four inundation scenarios are: 1) breach prior to overtopping; 2) overtopping with breach; 3) malfunction or improper operation of levee system components; and 4) levee overtopping without breach (also referred to as non-breach).

b. A levee system is defined as a manmade barrier along a watercourse with the principle function of excluding flood waters from a portion of the floodplain (referred to as the “leveed area”) for a limited range of flood events. A levee system is composed of one or more levee segments and other features that are collectively integral to excluding flood water from the leveed area. Levee features may consist of embankments, floodwalls, pipes and associated drainage features, closures, pumping stations, and channels. Highway and railroad embankments or other non-project segments that are integral to the performance of excluding flood water from the leveed area will be considered to be part of a levee system. Some Congressionally authorized projects can be composed of one or more levee systems. Other types of infrastructure, such as structures along canals, may meet the definition of a levee system and will be considered a part of the Levee Safety Program on a case by case basis.

2. With regard to TRGs, the Levee Safety Program uses a “tolerability of risk” framework with associated TRGs, originally developed in the United Kingdom and adapted elsewhere. The concept evolved from the recognition that absolute safety is not practical and that managing risks needs to reflect how people and society view risk. The tolerability of risk approach is a framework for reaching decisions by focusing on the most serious risks in a consistent, efficient, and transparent manner. USACE will use TRGs to inform the degree and priority of federal investments and actions; to make recommendations on non-federal investment to others on the same basis; and to determine if the risk associated with levee systems is “tolerable,” which is a judgment of the appropriateness of collective federal and non-federal efforts to manage that risk.

a. USACE will consider risk to life safety related to the TRGs from two perspectives, societal life risk and individual life risk. Societal life risk is the risk of widespread or large-scale catastrophes from the inundation of a leveed area that would result in a negative societal response. In general, society is more averse to risk if multiple fatalities were to occur from a single event. In contrast, society tends to be less averse to risks that result from many events resulting in only one or two fatalities, even if the total losses from the small events is larger than that from the single large event.

Individual life risk is represented by the probability of life loss for the identifiable person or group by location that is most at risk of loss of life due to a levee breach. Individual life risk is influenced by location, exposure, and vulnerability within a leveed area.

b. USACE will consider economic risk associated with the likelihood of direct and indirect economic losses within the leveed area or impacts on the national or regional economy. Direct economic risk can include damage to private and public buildings, contents of buildings, vehicles, public infrastructure such as roads and bridges, public utility infrastructure, agricultural crops, agricultural capital, erosion losses to land, and costs associated with cleaning up contaminates. Indirect economic risks are those associated with the loss of regional economic activity due to inundation of a leveed area..

c. USACE will also consider environmental risk associated with the likelihood of both direct and indirect impacts on natural, ecological, cultural, human, and historic resources, as well as impacts on the nation's security within the leveed area that typically cannot be measured in monetary terms.

3. The following defines the four TRGs and how USACE will consider each TRG in more detail.

a. TRG 1 – Understanding the Risk. The first tolerable risk guideline involves considering whether society is willing to live with the risk associated with the levee system to secure the benefits of living and working in the leveed area. In other words, answering the basic question – are the risks commensurate with the benefits? The process to evaluate this guideline will include a combination of considering the risk estimates from a risk assessment with qualitative factors. USACE will consider life safety, economic, and environmental risk for TRG 1 as described below.

(1) Evaluation of Life Safety Risk. The life safety risk matrix shown in Figure 1 will be used to guide the decision of whether the life safety risk associated with a levee system meets TRG 1 both from a societal and individual life risk perspective. Consideration of uncertainty in the risk estimates will be a factor in determining if life safety risk meets TRG 1, especially for those risk estimates that plot on or around the individual and/or societal risk lines. When the life safety risk has average loss of life of 1,000 or more with an annual exceedance probability of breach of 1.E-06 or less, those situations will be closely scrutinized prior to deciding if the risks are tolerable due to limitations with methods to estimate probabilities that low. For those situations where TRG 1 is met for societal life risk but not individual life risk, further considerations related to identifying the most at risk individuals in the leveed area; verifying the potential for life loss; and considering whether individuals exposed consider the benefits worth the levee risk will be taken into account for TRG 1.

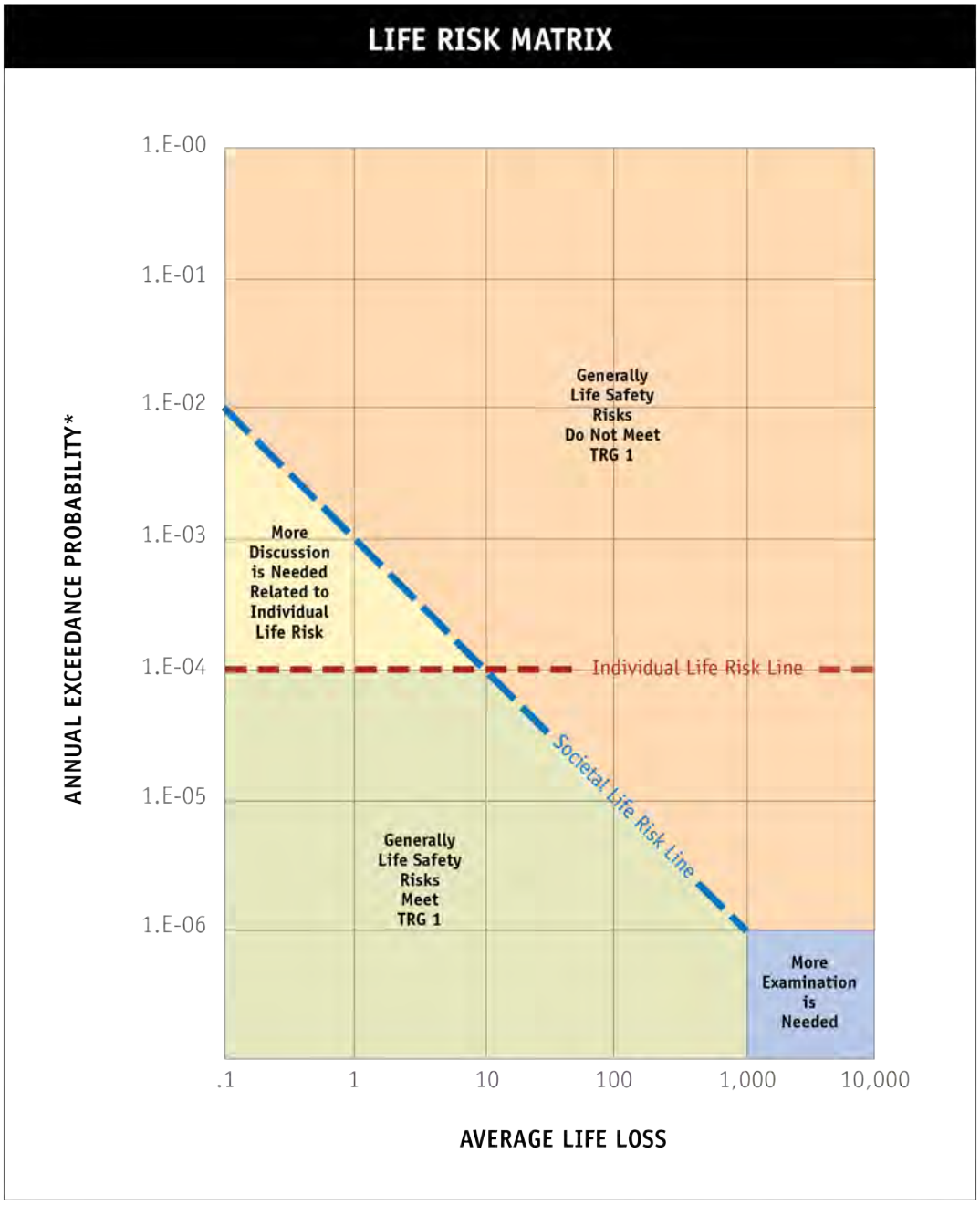

Figure 1. Life Risk Matrix

(2) Evaluation of Societal Life Risk. Risks that plot above the societal life risk line are considered unacceptable except in exceptional circumstances. Exceptional circumstances refer to a situation when USACE, acting on behalf of society, may determine that the life safety risks, although high, can be considered meeting TRG 1 based on benefits that the levee system brings to society at large and that additional risk reduction is not justified or feasible. Typically, it takes a feasibility level of effort to determine if this type of exceptional circumstance exists. Typically, risks that plot below the societal life risk line are considered to have met TRG 1 for life safety risk.

(3) Evaluation of Individual Life Risk. USACE has chosen to use 1 in 10,000 per year (1E-04) for the probability of life loss for an individual or group of individuals most at risk. The goal is to keep the risks associated with USACE program levees from increasing the probability of death for an individual above annual mortality rates. The individual tolerable risk line is shown in Figure 1.

(4) Evaluation of Economic Risk. After evaluating life safety risks related to Figure 1, USACE will consider how economic risks determined from the risk assessment may influence a determination for meeting TRG 1. Similar to risk estimates for life safety, when the economic risk associated with a seemingly remote annual exceedance probability of breach or overtopping with breach of 1.E-06 or less, those situations will be closely scrutinized.

(5) Evaluation of Environmental Risk. After evaluating life safety risks related to Figure 1, USACE will consider how the non-monetized risks determined from the risk assessment may influence a determination of meeting TRG 1.

b. TRG 2 – Building Risk Awareness. The second tolerable risk guideline involves determining that there is a continuation of recognition and communication of the levee risk, because the risk associated with levee systems are not broadly acceptable and cannot be ignored. The rationale for meeting TRG 2 will be determined qualitatively and may be met through USACE levee safety program activities and/or levees sponsor activities, which includes risk communication. The following questions should be considered for TRG 2.

(1) Does the levee sponsor(s) have access to and are they aware of the best available levee risk information? Examples of this include participation in screening or higher level risk assessments with USACE and updating and posting the Levee System Summary.

(2) Has the community in the leveed area been provided the best available risk information associated with the levee system? Examples include public engagement activities, media stories, or a current community website.

(3) Have flood risk (residual risk) and potential changes to flood risk over time been communicated to the community? Examples include public engagement activities, media stories, or a current community website.

c. TRG 3 – Fulfilling Daily Responsibilities. The third tolerable risk guideline involves determining that the risks associated with the levee system are being properly monitored and managed by those responsible for managing the risk. The rationale for meeting TRG 3 will be determined qualitatively and may be met through USACE levee safety program activities and/or levees sponsor activities. TRG 3 can be met through demonstrated monitoring and risk management activities. This would include an active operation and maintenance program, visual monitoring (documented regular inspections), updated and tested emergency plan, instrumentation program, and interim risk reduction measures plan.

d. TRG 4 – Actions to Reduce Risk. The fourth guideline is determining if there are cost effective, socially acceptable, or environmentally acceptable ways to reduce risks from an individual or societal risk perspective. If it is determined that there are no cost effective or acceptable ways to further reduce risks, USACE may consider this an exceptional circumstance and therefore might consider the levee risk to be tolerable even if the life safety risk exceeds the associated tolerability guideline under TRG 1. The following questions should be considered for TRG 4.

(1) Have appropriate actions been taken to reduce risks?

(2) Could any actions reasonably be taken that would reduce risks further?

(3) What is the cost to reduce the risk and how much is the risk reduced?

(4) Should actions be evaluated in a detailed study?

(5) Is there demonstrated progress towards implementing risk reduction measures?