

# Instructions for Form 3 - Riverine Structures

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This form should be used for revision requests that involve new or proposed channelization, bridges/culverts, dams/detention basins, and/or levee/floodwall systems (both accredited and, where applicable, non-accredited). The requester should only complete the sections of this form that apply to the revision request. A separate form should be used for each flooding source that has structures involved in the revision request.

Download [Form 3 - Riverine Structures](#).

## Section A: General

Provide the name of the structure (e.g., Main Street Bridge, Flood Creek channelization), the type of structure, the location of the structure (e.g., 1,000 feet upstream of Main Street, River Mile 10.4), and the appropriate cross-section labels for all structures that are part of the revision request.

Attach additional pages if the revision request involves more than three structures. This form is not required for existing structures that are included in the hydraulic model for the effective FEMA Flood Insurance Rate Map (FIRM), unless they are changed.

## Section B: Channelization

This section is to be completed when any portion of the stream channel is altered or relocated. The purpose of the Channelization section and the information to be submitted is to ensure that the channel will function properly as designed and convey the 1%-annual-chance flood as determined by the hydraulic analysis. When the completed Channelization section is submitted, a [Riverine Hydrologic & Hydraulic Form \(Form 2\)](#) must also be submitted.



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1. Indicate the hydraulic considerations for the design of the channel, such as flow-carrying capacity of the channel and the flow regime over which channel elevation was designed. Also indicate if there is potential for a hydraulic jump.
2. Attach engineering drawings of the channelization, certified by a registered Professional Engineer (P.E.). The drawings should include a plan view of the channelization that shows pre-construction topography and post-construction grading, channel cross section, channel lining, channel inlet and outlet, and details for any accessory structures included with the channelization.

Typically, channelization increases the channel velocity above the natural channel velocity. Provide information that supports the conclusion that the channel lining will withstand the velocities associated with the 1%-annual-chance flood. The type of channel lining should be indicated on the design plans.

3. Indicate all accessory structures included with the channelization. The accessory structures should be shown on the submitted plans.
4. In locations where sediment transport will affect the Base Flood Elevations (BFEs), the effects of sediment transport should be considered in the design of the channel and Section F of Riverine Structure Form 3 should be submitted. Provide justifications if sediment transport analysis is not considered for the channel design.

## Section C: Bridge/Culvert

This section is to be completed when the request involves a new bridge or culvert or a new or revised analysis of an existing bridge or culvert. Please provide the flooding source and structure name and continue with the form as instructed below.

1. Indicate the reason for the new or revised bridge/culvert modeling.
2. Indicate the model used to analyze the hydraulics at the bridge/culvert. If this model is different than the model used to analyze the flooding on the stream, please include an explanation of why a different model was used to analyze the bridge/culvert.
3. Attach plans of the structure, certified by a registered Professional Engineer. The bridge/culvert plans should include the information listed on the form



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and should reference the vertical datum. Indicate the items included on the plans and attach an explanation of why any information is not included.

4. In locations where sediment transport will affect the Base Flood Elevations, the effects of sediment transport should be considered in the design of the bridge/culvert and Section F of Riverine Structure Form 3 should be submitted. Provide justifications if sediment transport analysis is not considered for the bridge/culvert design.

## Section D: Dam/Basin

This section is to be filled out when there is an existing, proposed or modified dam or detention basin along a detailed-study stream. This includes existing or new road embankments that are designed or modified to serve as flood detention structures. Provide a complete engineering analysis and engineering drawings of the dam/basin. The drawings should indicate the dam dimensions (height, topwidth, side slopes) the crest elevation of the top of the dam/basin, the type of spillway, the spillway dimensions, the crest elevation of the spillway, the type of outlet, the outlet dimensions and the invert elevation of the outlet. Refer to the FEMA guidance document [Dams/Reservoirs and Non-Dam Features](#) for more details.

1. Indicate the reason for the revision request involving a dam/basin.
2. Indicate the agency or organization that designed the dam/basin.
3. Identification
  - a. Indicate the name of the agency or organization responsible for permitting the dam, along with the appropriate permit or identification number for the dam.
  - b. For a local dam or a private dam, provide related “as-built” or “proposed” drawings, specifications, and supporting design information.
4. Indicate if the hydrologic analysis is revised as a result of the dam/basin. Any storage upstream of the dam/basin, considered in the hydrologic analysis to reduce the peak base flood discharge, should be totally dedicated to flood control. If the outflow of the dam is regulated, submit an explanation of the flow regulation plan.

Provide this documentation as part of the Operation and Maintenance information required per Item 7. If the hydrology changes, complete the Riverine Hydrology & Hydraulics Form 2. Provide documentation showing



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that the dam/basin was designed using the critical storm duration that would yield the maximum reservoir stage or maximum volume of runoff during the design storm.

5. In locations where sediment transport will affect the Base Flood Elevations, the effects of sediment transport should be considered in the design of the dam/basin and Section F of the Riverine Structure Form 3 should be submitted. Provide justifications if sediment transport analysis is not considered for the dam/basin design.
6. Indicate if the Base Flood Elevations change as a result of the dam/basin. If impacted, list the stillwater elevations behind the dam/basin in the table provided.
7. Include a copy of the formal Operation and Maintenance Plan for the dam/basin.

## **Section E: Levee/Floodwall**

This section is to be completed, for both accredited and non-accredited levee systems, when the revision request involves a new, modified, and/or existing levee and/or floodwall. The National Flood Insurance Program regulations describe a levee as a manmade structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide flood hazard reduction from temporary flooding.

### **Accredited Levee Systems**

The purpose of this section is to ensure that the levee or floodwall system is designed and/or constructed to exclude the 1%-annual-chance flood from the leveed area, in full compliance with the National Flood Insurance Program regulations in the Code of Federal Regulations Title 44 Section §65.10, before reflecting its effects on a flood map. For more information on the FEMA requirements, refer to the Guidance for [Flood Risk Analysis and Mapping: Levees](#).

In addition, a vicinity map, along with a complete set of flood profile sheets, plan sheets, and layout detail sheets, must be submitted. These sheets must be numbered and must include an index that clearly identifies the sheets specifically relating to the levee or floodwall in question.



While the overall submittal for levee accreditation must be certified by a registered Professional Engineer who submits the completed package, the submittal may include several subsets of engineering data, dealing with separate portions of the National Flood Insurance Program regulations in the Code of Federal Regulations Title 44 Section §65.10, certified by different Professional Engineers or engineering firms.

Certifications are subject to the definition provided in the National Flood Insurance Program regulations at Code of Federal Regulations Title 44 Section §65.2. In such cases, the Professional Engineer who certifies the completed package will be considered the engineer responsible for the accreditation submittal and will be contacted if additional information is needed. The signature block on the Riverine Structure Form 3 should also be signed by the Professional Engineer who signs the complete package.

1. Indicate all the applicable levee/floodwall system elements, including their locations and types, and provide engineering drawings certified by a registered Professional Engineer. The drawings should show the items indicated.
2. Indicate the levee's amount of freeboard above the Base Flood Elevation. Riverine levees must provide a minimum freeboard of 3-feet above the Base Flood Elevation. An additional 0.5 foot above the minimum must be provided at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee.

An additional 1-foot above the minimum freeboard is required on both sides of the river or stream for a distance of 100-feet upstream of structures (such as bridges) riverward of the levee or wherever the flow is constricted. If exceptions to the minimum freeboard requirements are requested, attach documentation addressing the National Flood Insurance Program regulations in the Code of Federal Regulations Title 44 Section §65.10(b)(1)(ii).

In addition, provide a discussion of how the top of levee ties into high ground at both the upstream and downstream terminus locations and supporting documentation, including topographic information, drawings, etc.

Ice jams can increase the flood elevations on a stream. Indicate if the stream has a history of ice jams; if so, provide evidence that the minimum freeboard still exists with the ice jam effects.

3. List the closure devices for all openings through the levee system. All openings must be provided with closure devices that are structural parts of



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the system during operation and design.

4. Complete the information that shows where embankment protection is required and submit supporting embankment protection analysis. The embankment protection analysis must demonstrate that no appreciable erosion of the levee embankment can be expected during the 1%-annual-chance flood, as a result of either current or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation, directly or indirectly through reduction of the seepage path and subsequent instability.

Factors to be addressed include, but are not limited to: expected flow velocities, expected wind and wave action, ice loading, impact of debris, slope protection techniques, duration of flooding at various stages and velocities, embankment and foundation materials, levee alignment, bends, transitions, and levee side slopes. The table provided in the form is for riprap protection. If another method of embankment protection is used, prepare and submit a table with similar information.

5. Complete the information to summarize the analysis of the levee embankment and foundation. This analysis must evaluate both stability and seepage during the loading conditions associated with the base flood. The seepage analysis must demonstrate that seepage into or through the levee embankment and foundation will not result in seepage and piping that will jeopardize the embankment and foundation stability.

The slope stability analysis must demonstrate that the levee cross section is stable under all loading and unloading conditions for the base flood. The analysis should include the river or channel slopes. Guidance on seepage and stability analyses is outlined in the U.S. Army Corps of Engineers (USACE) Engineer Manual (EM) 1110-2-1913, "[Design and Construction of Levees](#)."

Visit the [U.S. Army Corps website](#) to download the Levees publication as well as Engineering Technical Letters and additional Engineer Manuals. The factors that must be addressed in these analyses include depth of flooding, duration of flooding, foundation conditions at the site, embankment and cut slope geometry and length of seepage path at the critical locations, internal drainage in the levee, seepage and/or stability berms, and management of trees and vegetation. All backup material for these analyses should be submitted.



6. Complete the information to summarize the analysis of the floodwall and foundation. Factors to be addressed include methods used, stability analyses submitted, loading conditions, and results. In addition, waterstops and joint materials should be incorporated into the floodwall design as outlined the Engineer Manual EM 1110-2-2102, "[Waterstops and Other Preformed Joint Materials for Civil Works Structures](#)," to prevent passage of water through the wall.
7. Complete the information to summarize the results from an analysis of potential settling of the levee. The settlement analysis must assess the potential and magnitude of future losses of freeboard and must demonstrate that the minimum freeboard requirements will be maintained. The analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods.  
In addition, a detailed settlement analysis and determination of the appropriate amount of overbuild must be submitted, using procedures such as those described in USACE EM [1110-1-1904](#), "[Settlement Analysis](#)," and USACE EM 1110-2-1913, "[Design and Construction of Levees](#)," Chapter 6. Submit all backup information used in the analysis.
8. Complete the information to summarize an analysis of potential flooding from interior drainage. In accordance with the National Flood Insurance Program regulations at Title 44 Section §65.10(b)(6), the interior drainage analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities for evacuating interior floodwaters.  
The analysis must identify the extent of the flooded area and the water-surface elevation(s) of the 1%-annual-chance flood if the average depth is greater than 1 foot. This information is to be shown on a certified topographic work map. Submit the calculation and backup information for the analysis of flooding potential from interior drainage.  
If a hydraulic model is used, it must be a FEMA-accepted model described on the FEMA website. Complete the information and attach any supporting documentation regarding the other design criteria indicated. In locations where sediment transport will affect the design of the levee, the effects of sediment transport should be considered, and Section F of Form 3 should be submitted. Provide justifications if sediment transport analysis is not considered for the levee design.



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9. Complete the information to summarize the operational plan and criteria. For a levee system to be recognized by FEMA, the operational criteria must be as described in the National Flood Insurance Program regulations in the Code of Federal Regulations Title 44 Section §65.10(c).

As noted in the National Flood Insurance Program regulations at Title 44 Section §65.10(c)(3), FEMA may require other operation plans and criteria. [FEMA Standard ID 444](#) requires that the submittal for levee accreditation include a current emergency preparedness plan that must, at a minimum, be adopted by the community, include the area impacted by the levee system, and have procedures for emergency operations and public evacuation. Although this plan may be included in the official operation plan, it may also be submitted as a separate document. The size and detail for this plan should be scaled as appropriate for the levee system. Many communities may already be familiar with similar planning efforts and have the relevant information available in other forms. If the information is appropriate to meet these requirements, the document is not required to have the title “emergency preparedness plan.”

Refer to the following documents for more information on preparing these plans and sample content and formats for the plans:

- FEMA publication: [Emergency Preparedness Guidelines for Levees](#), A Guide for Owners and Operators, July 2018  
This FEMA document may be downloaded from FEMA’s website at [www.fema.gov](http://www.fema.gov). Search “Guidelines for Levees A Guide for Owners.” Or request a copy of the document by calling the FEMA Mapping and Insurance eXchange (FMIX) at 1-877-FEMA MAP (1-877-336-2627).
- U.S. Army Corps of Engineers publication: The Silver Jackets “[Emergency Action Plan, Guidebook](#), Version 4.0,” November 2019.
- U.S. Army Corps of Engineer publication: [Engineer Circular \(EC\) 1110-2-6074](#), Guidance for Emergency Action Plans, Incident Management and Reporting, and Inundation Maps for Dams and Levee Systems, January 31, 2018.

10. Indicate if the maintenance plan for the levee complies with the National Flood Insurance Program regulations in the Code of Federal Regulations Title 44 Section §65.10(d). This plan should address maintenance standards, intervals, and procedures. This plan should also include the design and construction requirements and inspection procedures for future utility crossings. In addition, include requirements for management of vegetation



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as outlined in in the U.S. Army Corps of Engineers [Landscape Planting and Vegetation Management for Floodwalls, Levees and Embankment Dams](#) Engineer Manual 1110-2-583.

11. When requesting a Conditional Letter of Map Revision, a draft version of the Operations & Maintenance Plan must be submitted for a proposed levee. However, a final copy will be required after the levee is constructed and a revision to the Flood Insurance Rate Map is requested. In addition, the final copy of the Operations & Maintenance Plan must be formally adopted by the community or agency responsible for carrying out the specified activities. The Operations and Maintenance Plan must also record the person in charge of the maintenance activities.

## **Non-Accredited Levee Systems**

FEMA developed an updated process to analyze and map areas on the landward side of non-accredited levee systems that are shown on National Flood Insurance Program maps. Information on this updated process is provided in two FEMA publications: "[Analysis and Mapping Procedures for Non-Accredited Levee Systems, New Approach](#)" July 2013 and "[Guidance for Flood Risk Analysis and Mapping: Levees.](#)"

Data requirements for this updated process in many cases will require certified data and analyses of the levees and/or floodwalls as part of the non-accredited levee system. As such, the same information described above for accredited levee systems may be required. These forms and requirements above should be used, as appropriate, for non-accredited levee system submittals.

## **Section F: Sediment Transport**

Complete the information to summarize an analysis of sediment transport (including scour and deposition) if there is any indication from historical records that sediment transport can affect the Base Flood Elevation. Or complete the information if based on the stream morphology, vegetative cover, development of the watershed, and bank conditions, there is a potential for debris and sediment transport to affect the Base Flood Elevation or a structure.

If sediment transport will not affect the Base Flood Elevation or a structure, indicate that this section is not applicable and explain why a sediment analysis



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was not performed. Bulked flows are used to evaluate the performance of a structure during the 1%-annual-chance flood; however, FEMA does not map Base Flood Elevations based on bulked flows.

