

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires December 31, 2010

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC, 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: _____

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete and submit the appropriate section(s) for each Structure listed below:

- Channelization.....complete Section B
- Bridge/Culvert.....complete Section C
- Dam.....complete Section D
- Levee/Floodwall.....complete Section E
- Sediment Transport.....complete Section F (if required)

Description of Structure

1. Name of Structure: _____

Type (check one): Channelization Bridge/Culvert Levee/Floodwall Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

2. Name of Structure: _____

Type (check one): Channelization Bridge/Culvert Levee/Floodwall Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

3. Name of Structure: _____

Type (check one): Channelization Bridge/Culvert Levee/Floodwall Dam

Location of Structure: _____

Downstream Limit/Cross Section: _____

Upstream Limit/Cross Section: _____

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: _____

Name of Structure: _____

1. Hydraulic Considerations

The channel was designed to carry _____ (cfs) and/or the _____-year flood.

The design elevation in the channel is based on (check one):

- Subcritical flow
- Critical flow
- Supercritical flow
- Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

- Inlet to channel
- Outlet of channel
- At Drop Structures
- At Transitions

Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The Channelization includes (check one):

- Levees [Attach Section E (Levee/Floodwall)]
- Drop structures
- Superelevated sections
- Transitions in cross sectional geometry
- Debris basin/design basin [Attach Section D (Dam/Basin)]
- Energy dissipator
- Weir
- Other (Describe): _____

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? Yes No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach explanation.

Flooding Source: _____

Name of Structure: _____

- Bridge/culvert not modeled in the FIS
- Modified bridge/culvert previously modeled in the FIS
- New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8):

If different hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- Dimensions (height, width, span, radius, length)
- Erosion Protection
- Shape (culverts only)
- Low Chord Elevations - Upstream and Downstream
- Material
- Top of Road Elevations - Upstream and Downstream
- Beveling or Rounding
- Structure Invert Elevations - Upstream and Downstream
- Wing Wall Angle
- Stream Invert Elevation - Upstream and Downstream
- Skew Angle
- Cross-Section Locations
- Distance Between Cross Sections

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? Yes No

If yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM

Flooding Source: _____

Name of Structure: _____

1. This request is for (check one): Existing dam New dam/basin Modification of existing dam/basin
2. The dam/basin was designed by (check one): Federal agency State agency Local government agency

Name of the agency or organization: _____

3. The dam was permitted as (check one): Federal Dam State Dam

Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

Permit or ID number _____ Permitting Agency or Organization _____

- Local Government Dam Private Dam

Provide related drawings, specifications and supporting design information.

4. Does the project involve hydrology? Yes No

If yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

Was the dam/basin designed using critical duration storm? (Must account for the maximum volume of runoff?)

- Yes, provide supporting documentation with your completed Form 2.
- No, provide written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? Yes No

If Yes, then fill out Section F (Sediment Transport).

If No, then attach your explanation for why debris/sediment analysis was not considered.

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change?

Yes No If Yes, complete the Riverine Hydrology & Hydraulic Form (Form 2) and complete the table below.

FEQUENCY (% annual chance)	Stillwater Elevation Behind the Dam FIS	REVISED
10-year (10%)	_____	_____
50-year (2%)	_____	_____
100-year (1%)	_____	_____
500-year (0.2%)	_____	_____
Normal Pool Elevation	_____	_____

7. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements (continued)

- a. This levee/Floodwall analysis is based on (check one): upgrading of an existing levee/floodwall system reanalysis of an existing levee/floodwall system a newly constructed levee/floodwall system

- b. Levee elements and locations are (check one):

- earthen embankment, dike, berm, etc. Station to
- structural floodwall Station to
- other (describe) Station to

c. Structural Type (check one): monolithic cast-in place reinforcement concrete reinforced concrete masonry block sheet piling
 other (describe)

d. Has the levee/floodwall system been certified by a Federal agency to provide protection from the base flood? Yes No

If yes, by which agency? _____

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

- 3.0 feet or more at the downstream end and throughout Yes No
- 3.5 feet or more at the upstream end Yes No
- 4.0 feet within 100 feet upstream of all structures and/or constrictions Yes No

Coastal

- 1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater). Yes No
- 2.0 feet above the 1%-annual-chance stillwater surge elevation Yes No

Please note, occasionally exceptions are made to the minimum freeboard requirements. If an exception is required, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? Yes No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exist.

3. Closures

a. Openings through the levee system (check one): exist does not exist

If opening exist, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

E. LEVEE/FLOODWALL (continued)

Note: Geotechnical and geologic data

In addition to the required detailed analysis report, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulation summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-110-2-1906 Form 2086)1

4. Embankment Protection

- a. The maximum levee slope landside is:
- b. The maximum levee slope floodside is:
- c. The range of velocities along the levee during the base flood is: (min) to (max.)
- d. Embankment material is protected by (describe what kind):
- e. Riprap Design Parameters (check one): Velocity Tractive stress

Attach references

Reach	Slideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D ₁₀₀	D ₅₀	Thickness	
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								
Sta _____ to _____								

4. Embankment Protection Continued

- f. Is a bedding analysis and design attached Yes No
- g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

- a. Identify locations and describe the basis for selection of critical location for analysis:

Overall height: Sta.: _____, height _____ ft.

Limiting foundation soil strength

Sta.: _____, depth _____ to _____
 Strength θ = _____ degrees, c = _____ psf
 Slope: SS = _____ (h) to _____ (v)

(Repeat as needed on an added sheet for additional locations)

- b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

- c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Critical Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

E. LEVEE/FLOODWALL (continued)

- d. Was a seepage analysis for the embankment performed? Yes No
 If Yes, describe methodology used: _____
- e. Was a seepage analysis for the foundation performed? Yes No
- f. Were uplift pressures at the embankment landside toe checked? Yes No
- g. Were seepage exit gradients checked for piping potential? Yes No
- h. The duration of the base flood hydrograph against the embankment is _____ hours.
 Attach engineering analysis to support construction plans.

6. Floodwall and Foundation Stability

- a. Describe analysis submittal based on Code (check one): UBC (1988) Other (specify): _____
- b. Stability analysis submitted provides for: Overturning Sliding If not, explain: _____
- c. Loading included in the analysis where: lateral earth @ PA= _____ psf; Pp = psf
 Surcharge-Slope @ _____, surface _____ psf
 Wind @ Pw = _____ psf
 Seepage (Uplift): _____ Earthquake @ Peq = _____ %g
 1%-annual-chance significant wave height _____ ft.
 1%-annual-chance significant wave period _____ sec.
- d. Summary of Stability Analysis Results: Factors of Safety.
 Itemize for each range in site lay out dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept. 1986; USACE EM 1110-2-25020
 Note: Extend table on an added sheet as needed and reference)

- e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

- f. Foundation scour protection is, is not provided. If provided, attach explanation and supporting documentation.
 Attach engineering analysis to support construction plans.

7. Settlement

- a. Has anticipated potential settlement been determined and incorporated into the specific construction elevations to maintain the established freeboard margin? Yes No
- b. The computed range of settlement is _____ ft. to _____ ft.

E. LEVEE/FLOODWALL (continued)

7. Settlement (continued)

- c. Settlement of the levee crest is determined to be primarily from: Foundation consolidation Embankment compression
 Other (describe): _____
- d. Differential settlement of floodwalls has has not been accommodated in the structural design and construction.
 Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: _____ acres
 Draining to ponding area: _____ acres

b. Relationships Established

- Ponding elevation vs. storage Yes No
 Ponding elevation vs. gravity flow Yes No
 Differential head vs. gravity flow Yes No

c. The river flow duration curve is enclosed: Yes No

d. Specify the discharge capacity of the head pressure conduit: _____ cfs

e. Which flooding conditions were analyzed?

- * Gravity flow (Interior Watershed) Yes No
- * Common storm (River Watershed) Yes No
- * Historical ponding probability Yes No
- * Coastal wave overtopping Yes No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. Yes No If No, attach explanation

g. The rate of seepage through the levee system for the base flood is _____ cfs

h. The length of levee system used to drive this seepage rate in item g: _____ ft.

i. Will pumping plants be used for interior drainage? Yes No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? Yes No

E. LEVEE/FLOODWALL (continued)

8. Interior Drainage (continued)

If the pumps are electric, are there backup power sources? Yes No

(Reference: USACE EM-1110-2-3101, 3102, 3103, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquification is is not a problem

Hydrocompaction is is not a problem

Heave differential movement due to soils of high shrink/swell is is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation.

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?

Yes No Attach supporting documentation.

d. Sediment Transport Considerations?

Was sediment transport considered? Yes No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan and Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations? Yes No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?

Yes No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?

Yes No If the answer is No to any to the above, please attach supporting documentation.

11. Maintenance Plan

Please attach a copy of the formal maintenance plan for plan for the levee/floodwall.

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name	License No.	Date
Company Name	Telephone No.	Fax No.
Signature	Date	E-Mail Address

F. SEDIMENT TRANSPORT

Flooding Source: _____
 Name of Structure: _____

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet
 Debris load associated with the base flood discharge: Volume _____ acre-feet
 Sediment transport rate _____ (percent concentration by volume)
 Method used to estimate sediment transport: _____
 Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.
 Method used to estimate scour and/or deposition: _____
 Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.