

**PAPERWORK REDUCTION ACT**

Public reporting burden for this form is estimated to average 7 hours 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, U.S. 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 the appropriate section(s) for each Structure listed below:

- Channelization.....complete Section B
- Bridge/Culvert.....complete Section C
- Dam/Basin.....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/Basin

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

**2. Name of Structure:**

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

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

**3. Name of Structure:**

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

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. Accessory Structures

The channelization includes (check one):

- |  |  |
|--|--|
| <input type="checkbox"/> Levees [Attach Section E (Levee/Floodwall)]                 | <input type="checkbox"/> Drop structures                         |
| <input type="checkbox"/> Superelevated sections                                      | <input type="checkbox"/> Transitions in cross sectional geometry |
| <input type="checkbox"/> Debris basin/detention basin [Attach Section D (Dam/Basin)] | <input type="checkbox"/> Energy dissipator                       |
| <input type="checkbox"/> Other (Describe):   |  |

2. Drawing Checklist

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

3. 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):

4. 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.

## C. BRIDGE/CULVERT

Flooding Source:

Name of Structure:

1. This revision reflects (check one):

- Bridge/culvert not modeled in the FIS  
 Modified bridge/culvert previously modeled in the FIS  
 Revised 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 than 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):

- |   |  |
|---|--|
| <input type="checkbox"/> Dimensions (height, width, span, radius, length) | <input type="checkbox"/> Erosion Protection                                    |
| <input type="checkbox"/> Shape (culverts only)                            | <input type="checkbox"/> Low Chord Elevations – Upstream and Downstream        |
| <input type="checkbox"/> Material   | <input type="checkbox"/> Top of Road Elevations – Upstream and Downstream      |
| <input type="checkbox"/> Beveling or Rounding                             | <input type="checkbox"/> Structure Invert Elevations – Upstream and Downstream |
| <input type="checkbox"/> Wing Wall Angle                                  | <input type="checkbox"/> Stream Invert Elevations – Upstream and Downstream    |
| <input type="checkbox"/> Skew Angle                                       | <input type="checkbox"/> Cross-Section Locations                               |
| <input type="checkbox"/> Distances Between Cross Sections                 |  |

4. 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.

**D. DAM/BASIN**

Flooding Source:

Name of Structure:

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

Name of the agency or organization:

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

- a.  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

- b.  Local Government Dam  Private Dam

Provide related drawings, specification and supporting design information.

4. Does the project involve revised hydrology?  Yes  No

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

Was the dam/basin designed using critical duration storm?

- Yes, provide supporting documentation with your completed Form 2.
- No, provide a 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 or downstream of the dam change?

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

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	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

a. This Levee/Floodwall analysis is based on (check one):

- checkbox upgrading of an existing levee/floodwall system
checkbox a newly constructed levee/floodwall system
checkbox reanalysis of an existing levee/floodwall system

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

- checkbox earthen embankment, dike, berm, etc. Station to
checkbox structural floodwall Station to
checkbox Other (describe): Station to

c. Structural Type (check one):

- checkbox monolithic cast-in place reinforced concrete
checkbox reinforced concrete masonry block
checkbox sheet piling
checkbox Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

- checkbox Yes checkbox 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 checkbox Yes checkbox No
3.5 feet or more at the upstream end checkbox Yes checkbox No
4.0 feet within 100 feet upstream of all structures and/or constrictions checkbox Yes checkbox 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). checkbox Yes checkbox No
2.0 feet above the 1%-annual-chance stillwater surge elevation checkbox Yes checkbox No

**E. LEVEE/FLOODWALL (CONTINUED)**

2. Freeboard (continued)

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, 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 exists.

3. Closures

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

If opening exists, 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)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

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	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D <sub>100</sub>	D <sub>50</sub>	Thickness	
Sta    to								
Sta    to								
Sta    to								
Sta    to								
Sta    to								
Sta    to								

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

**E. LEVEE/FLOODWALL (CONTINUED)**

4. Embankment Protection (continued)

- f. Is a bedding/filter 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  $\phi$  =       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	Criteria (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)

- 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.

**E. LEVEE/FLOODWALL (CONTINUED)**

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

UBC (1988) or  Other (specify):

b. Stability analysis submitted provides for:

Overturning  Sliding If not, explain:

c. Loading included in the analyses were:

Lateral earth @  $P_A =$  psf;  $P_p =$  psf

Surcharge-Slope @ ,  surface psf

Wind @  $P_w =$  psf

Seepage (Uplift);  Earthquake @  $P_{eq} =$  %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 layout 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 1110-2-2502)

(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.

E. LEVEE/FLOODWALL (CONTINUED)

7. Settlement

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



**E. LEVEE/FLOODWALL (CONTINUED)**

8. Interior Drainage (continued)

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

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

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area 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:

- Liquefaction  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.

**E. LEVEE/FLOODWALL (CONTINUED)**

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 of the above, please attach supporting documentation.

11. Maintenance Plan

- a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations?  Yes  No  
If No, please attach supporting documentation.

12. Operations and Maintenance Plan

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

**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.