Attachment 20 – Devereux Creek Flood Analysis
(Stantec, 2016)
Devereux Creek Flood Analysis

An evaluation of the reduction in flood impacts due to the implementation of the UCSB North Campus Open Space Restoration Project

Prepared for:
ESA, Inc.

Prepared by:
Craig A. Steward, P.E., CFM

June 3, 2016
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<th>Description</th>
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<th>Quality Check</th>
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<td>6/3/16</td>
<td>S.Wang</td>
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Sign-off Sheet

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Craig A. Steward, P.E., CFM

Reviewed by ____________________________

Steve Wang, P.E. LEED AP, QSD/P
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Executive Summary

The Devereux Creek Flood Analysis identifies the hydraulic impacts expected to occur due to water surface elevations due to the proposed grading and structural changes proposed as the UCSB North Campus Open Space Restoration Project. These changes include:

- Excavation of approximately 350,000 cubic yards of soil
- Lowering of the Devereux Creek Main Reach sufficiently to allow saline water to enter from the Venoco Crossing to near the confluence Tributary 2 (Phelps Ditch).
- Construction of four new bridges or crossings – three in Tributary 3 and one over Tributary 2 (Phelps Ditch).
- Removal of one existing pedestrian bridge over Tributary 2 (Phelps Ditch).

As a result of the grading changes which generally involve mass grading and the removal of sediment from the channel, between the Venoco Crossing and Phelps Road, there will be a reduction in the 100-year water surface elevation generally ranging between 1.5 and 2 feet. This reduction in the flood elevation will remove eight (8) single family dwelling units and approximately sixteen (16) condominium units in two locations.

Within the affected area there will be no rise in the 100-year water surface elevation that will negatively impact property owners other than UCSB.
DEVEREUX CREEK FLOOD ANALYSIS

### Abbreviations

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<tr>
<td>cfs</td>
<td>Cubic feet per second</td>
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<td>University of California at Santa Barbara</td>
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\(^1\) Software program supplied by the U.S. Army Corp of Engineers Hydrologic Engineering Center.
DEVEREUX CREEK FLOOD ANALYSIS

PURPOSE OF THE REPORT
June 3, 2016

1.0 PURPOSE OF THE REPORT

The purpose of this report is to document the methods and assumptions used in this Devereux Creek flood analysis to support funding request from Santa Barbara County Flood Control District and for submittal of a Conditional Letter of Map Revisions (CLOMR) to the Federal Emergency Management Agency (FEMA).

2.0 LOCATION

Devereux Creek is located west of Storke Avenue, adjacent to the University of California at Santa Barbara (UCSB) Married Student Housing, and about 10 miles west of the City of Santa Barbara, California. See Figure 1. The evaluation encompasses the following Santa Barbara County Assessor Parcel Numbers:

- 073-063 - various
- 073-090-056
- 073-090-071
- 073-090-074

This study evaluates the portion of Devereux between the Pacific Ocean and Phelps Road. It includes the main reach as well as Devereux Slough, Tributary 2 (Phelps Ditch) and Tributary 3 (unnamed extension south of Whittier Drive). See Figure 2.

Figure 1 - Vicinity Map
3.0 BACKGROUND

In the early 1960s, Ocean Meadows Golf Course was developed by University Exchange Properties along the banks of Devereux Creek. The golf course was constructed by excavating adjacent hillsides to creek and filling in the creek banks to create gentle slopes along the Creek. This fill along with urban development within the watershed has created a situation where there has been a reduction in habitat values, increased shallow flooding in adjacent neighborhoods, and difficulty in maintaining the channel through the golf course.

In 2013, the Trust for Public Land purchased the Ocean Meadows Golf Course and donated to UCSB with the intention of restoring this reach of Devereux Creek to a more natural state. ESA
DEVEREUX CREEK FLOOD ANALYSIS

METHODS AND ASSUMPTIONS
June 3, 2016

Inc. has entered into a contract with UCSB to prepare grading plans and evaluate the impacts of these grading improvements on the 100 year flood elevations. Stantec Consulting Services Inc. has been selected to assist ESA in evaluating the changes in flood conveyance and to prepare a submittal that would be forwarded to FEMA for a CLOMR.

4.0 METHODS AND ASSUMPTIONS

The following sections outline the methods and assumptions used in the analysis of Devereux Creek and its tributaries.

4.1 TOPOGRAPHIC INFORMATION

All elevation and survey information presented in this report is based on NAD83 horizontal datum and NAVD1988 vertical datum. Topographic mapping was prepared by Stantec Consulting Services Inc. based on aerial photography dated March 2016 and detailed survey fill-in. In addition to the aerial photography, ESA collected some bathymetric data in the Devereux Slough.

Using this survey information, two surfaces were prepared by ESA for the use of flood analysis:

- Pre-project (current condition)
- Post-project (with proposed grading)

Topographic data was visually verified and photographically documented.

4.2 MODELING

Hydraulic modeling was prepared using HEC-RAS version 5.0. Three models were prepared:

- Duplicate Effective Model - Using data received from FEMA\(^2\), an effective model (representing the information that FEMA has used to determine current flood elevations) was prepared and checked against published water surface elevations. Data was available for the Main Reach and Tributary 2 (Phelps Ditch). No runs were available for Tributary 3 (unnamed creek).

- Existing Condition Model - Using sections cut from the Pre-Project surface and available survey and record information on bridges and culverts, a model was prepared evaluating the current condition of the study reaches of Devereux Creek. Elevations within the Devereux Slough were adjusted using bathymetric data from ESA to more accurately model ground elevations below the ponded water of the slough which was not accurately depicted in the aerial topography.

\(^2\) LOMR 12-09-0332P reissued as LOMR 12-09-393P
DEVEREUX CREEK FLOOD ANALYSIS

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- Proposed Condition Model - Using the same sections cut from the Pre-Project surface in areas not subject to change and new sections cut from the post-project surface, a model was prepared showing proposed improvements which included:
  - Significant grading; and
  - Construction of four pedestrian access structures
- Proposed Condition Floodway Model - using the proposed condition model results, a floodway was calculated initially using Type 4 and Type 5 encroachments (equal conveyance reduction) and later fine-tuned using Type 1 encroachments.

Model results, including exhibits, MT-3 forms, and tables are included in Appendix C. Although the analysis extends from the Pacific Ocean to upstream of Phelps Road, the FEMA evaluation area will be limited to those areas affected by the proposed improvements which begin at the Pacific Ocean and extend upstream to where the proposed 100-year flood elevations and floodplain widths match the effective model.

4.3 FLOW RATES

The peak flow rates used in the analysis were taken from the FEMA data supplied from previous LOMRs. See Table 1. FEMA data only includes the 100-year flow rates.
DEVEREUX CREEK FLOOD ANALYSIS

METHODS AND ASSUMPTIONS
June 3, 2016

Table 1 - Peak Flow Rates Used in the Analysis

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<td>Main reach between Tributary 2 and Tributary 3</td>
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<td>Main reach downstream of Tributary 3 to the downstream end of the Devereux Slough</td>
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<td>Tributary 2 from Phelps Road to the confluence with the main reach.</td>
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<td>Tributary 3 from Storke Road to the confluence with the main reach.</td>
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*No effective data was received from FEMA on Tributary 3. There is no flow change evident from the discharge of Tributary 3 to the main reach. An arbitrary flow rate was applied to Tributary 3.

4.4 STARTING WATER SURFACE ELEVATIONS

Starting elevations at the confluence with the Pacific Ocean were based on starting water surface elevation used in the effective analysis. Additionally, initial cross section elevation (which represents a sand bar that washes out annually during high flow) was configured in accordance with data developed by ESA during the past year of observations and measurement.

4.5 MANNING ROUGHNESS VALUES AND MINOR LOSSES

Mannings roughness values were based on field observation, review of aerial photography and Google Earth. Devereux Creek Main Reach and Tributary 3 are both largely open grassed areas with little in the way of obstructions. Phelps Ditch has been successfully revegetated in the main channel area forming a dense canopy, but leaving the channel bottom (w =10' to 15') clear of vegetation due to significant shading.

Expansion and Contraction losses were assumed to be 0.1 and 0.3 in most channel areas. Around bridges they were set to 0.3 and 0.5 in accordance with standard practice.

Areas that did not contribute to significant conveyance were modeled as ineffective.
DEVEREUX CREEK FLOOD ANALYSIS

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4.6 SCOUR ESTIMATION AND COUNTERMEASURE DESIGN

Scour at the Venoco Bridge Crossing will be evaluated using the methodologies found in the following United States Department of Transportation publications:

- HEC-11, Design of Rip-Rap Revetment
- HEC-18, Evaluating Scour at Bridges
- HEC-23, Bridge Scour and Stream Instability counter Measures, 3rd Edition, Volume 1

At this time, insufficient detail has been available to allow an evaluation of scour and countermeasures at this location.

5.0 FINDINGS

The following information was determined from the various analyses. Detailed results are included in the Appendices.

FEMA MT-2 Submittal forms have been roughly compiled in Appendix C. However, the information shown on them will likely eventually be converted to on-line submittals as this is the preferred method of data submission by FEMA.

5.1 DUPLICATE EFFECTIVE ANALYSIS

The duplicate effective was taken from the HEC-RAS data supplied by FEMA. The results were compared to the Flood Insurance Study (FIS) elevations, Table 6, the FIS profiles, and the Digital Flood Insurance Rate Maps (DFIRM). The typical range of accuracy is that the duplicate effective model elevations should be within about 0.5 ft of the published values.

Slight inconsistencies were found in the DFIRM section locations and the information presented on the FIS profile for the Main Reach of Devereux Creek. When compared to the hydraulic model, it was clear that the DFIRM location information for Section I and Section J were misplaced. The FIS profile and stationing found to correspond to the effective model.

Tributary 2 values from the FEMA-supplied Duplicate Effective model did not match up very well with the DFIRM values or the Effective data supplied with the LOMR report dated October 4, 2011 (also supplied by FEMA). Post-Project water surface elevations were compared to both the duplicate effective and pre-project values.

The work map in Appendix B contains the approximate cross section locations which were scaled from available information and cross checked against items of known locations.
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Refer to the following tables and figures in the report.

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Figure 9 - Floodway Data Table 6 for Tributary 2 and Tributary 3
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Table 3 - Duplicate Effective Results for Tributary 2
Table 4 - Duplicate Effective Results for Tributary 3
# Table 2 - Duplicate Effective Results for Devereux Creek, Main Reach

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Figure 3 - Main Reach - Duplicate Effective Comparison

Figure 4 - Main Reach Duplicate Effective Comparison
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Figure 5 - Floodway Data for Devereux Creek Main Reach
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Figure 6 - Portion of FIRM Panel 1342
Figure 7 - Portion of FIRM Panel 1361
## DEVEREUX CREEK FLOOD ANALYSIS

### FINDINGS

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### Table 3 - Duplicate Effective Results for Tributary 2

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DEVEREUX CREEK FLOOD ANALYSIS

FINDINGS
June 3, 2016

Figure 8 - Tributary 2 Duplicate Effective Comparison
DEVEREUX CREEK FLOOD ANALYSIS

FINDINGS
June 3, 2016

Figure 9 - Floodway Data Table 6 for Tributary 2 and Tributary 3

Table 4 - Duplicate Effective Results for Tributary 3

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Figure 10 - Tributary 3 Duplicate Effective Comparison

5.2 EXISTING ANALYSIS

The existing conditions evaluation was prepared using a surface prepared by ESA from which cross sections were cut. Using these methods, cross sections and results are georeferenced. Specific changes that are reflected in the existing model that are different than the duplicate effective model are:

- Removal of a bridge in the main reach at Station 4425.
- Much more accurate and detailed topographic definition.

Table 5, Table 6, and Table 7 compare the existing 100-year flood elevation to the effective 100-year water surface elevation.

Figure 11 shows the 100-year water surface inundation limits (limits shown in cyan).
# DEVEREUX CREEK FLOOD ANALYSIS

**FINDINGS**

June 3, 2016

## Table 5 - Main Reach Comparison of Existing Condition to Effective Condition

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Notes:
- 1. Compared to LOMR Report Table 2 or DFRM data
- 2. Compared to Duplicate Effective
- 3. Compared to Duplicate Effective
- 4. Compared to Existing/Pre-Project
Table 6 - Tributary 2 Comparison of Existing Condition to Proposed Condition

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Notes:
1. Compared to LOMR Report Table 3 or DFIRM data
2. Compared to Duplicate Effective
3. Compared to Duplicate Effective
4. Compared to Existing/Pre-Project

Table 7 - Tributary 3 Comparison of Existing Condition to Effective Condition

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Notes:
1. Not available.
2. Compared to Duplicate Effective
Figure 11 - Existing Condition Inundation Limits
5.3 PROPOSED ANALYSIS

The proposed analysis is based on grading concepts prepared and delivered by ESA in the form of an electronic surface. The proposed grading and structural improvements include:

- Removal of an existing golf bridge on Tributary 2 at about Station 150
- Construction of 3 bridges in Tributary 3 (Bridges A, B, and C)
- Construction of a new pedestrian bridge in Tributary 2 at about Station 160

A comparison of the proposed condition water surface elevations and the duplicate effective water surface elevations are provided in Table 9, Table 10, and Table 11.

Figure 12 shows the inundation limits of the proposed condition analysis outlined in cyan. More detailed inundation mapping is found in Appendix B. Table 8 identifies the parcels may be removed from the 100-year floodplain.

Table 8 - Residential Units Removed from the Floodplain

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A Floodway evaluation has been completed as part of the proposed analysis. Encroachments were applied using equal conveyance reduction methods until there was no more than a one foot rise. There are no negative surcharges. There is one section for which a greater than one foot rise was experienced which is within the Marymount Driveway Bridge in Tributary 2. A program bug has been reported indicating similar erroneous results for HEC-RAS V5.0.1.

\(^3\) The exact number of condominiums will depend on foundation and wall conditions which will require field verification and possibly review of the architectural plans.
### Table 9 - Main Reach Comparison of Proposed Condition to Effective Condition

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**Notes:**

1. Compared to LOMR Report Table 2 or DFIRM data
2. Compared to Duplicate Effective
3. Compared to Duplicate Effective
4. Compared to Existing/Pre-Project
DEVEREUX CREEK FLOOD ANALYSIS

FINDINGS
June 3, 2016

Table 10 - Tributary 2 Comparison of Proposed Condition to Effective Condition

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Notes:
1. Compared to LOMR Report Table 3 or DFIRM data
2. Compared to Duplicate Effective
3. Compared to Duplicate Effective
4. Compared to Existing/Pre-Project

Table 11 - Tributary 3 Comparison of Proposed Condition to Effective Condition

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Notes:
1. HEC-RAS model not available.
2. Compared to DFIRM Effective
3. Compared to DFIRM Effective
4. Compared to Existing/Pre-Project
Figure 12 - Proposed Condition Inundation Limits

Floodway limits have been prepared for the Main Reach of Devereux Creek, Tributary 2 and Tributary 3.
6.0 CONCLUSIONS

Based on the evaluation provided in this report, we can make the following conclusions:

1. A duplicate effective model matches the effective data with the accepted level of precision (0.5 feet) for the Main Reach and Tributary 3.

2. The duplicate effective model for Tributary 2 was found to exceed the 0.5 margin at sections 940 and 965. This was not considered serious since the final matching location is downstream of both these sections.

3. The existing condition model substantially approximates the duplicate effective model. There are a few exceptions. Within the Devereux Slough, the water surface elevation is higher by less than 0.5 feet which may be due to historic sedimentation or more accurate topographic mapping. An increase in the 100-year water surface elevation of greater than 0.5 feet is also shown at section 4017 which may indicate a slight misalignment of one of the cross sections. Neither of these situations is considered serious because the entire affected inundated area is owned by the project partners which can accept this rise on its own property.

4. The proposed condition model shows significant (approximately 1.5 feet) reduction in the 100-year water surface elevation within the main reach upstream of the Venoco Crossing and throughout Tributary 3. Reduction of water surface elevations within Tributary 2 is limited to the area impacted by proposed grading.

5. The Proposed/Post-Project model for Devereux Creek Main Reach comes to match the Duplicate Effective model and Existing/Pre-Project Model in the vicinity of sections 9232 and 9400. Tributary 2 models match at section 691. Tributary 3 does not need to match as it is a ponded water condition.

6. A Regulatory Floodway was determined for all reaches.

7. Eight (8) single family residences and up to sixteen (16) condominium units may be removed from the 100-year floodplain.
APPENDIX A – NO RISE CERTIFICATE
DEVEREUX CREEK FLOOD ANALYSIS

Appendix A
June 3, 2016

Appendix A

A.1 NO RISE CERTIFICATION
CERTIFICATION OF A "NO-RISE" DETERMINATION
FOR A PROPOSED FLOODWAY DEVELOPMENT

Santa Barbara County
Community Name

UCSB North Campus Open Space
Restoration Project
Development Name
APU 073-090-089, 056, 062, 067
Lot/Property Designation
UCSB
Property Owner

I hereby certify that the proposed remedial measures, in combination with the property
development designated above, will result in no loss of flow conveyance during the occurrence
of the 1 percent annual chance of exceedence (100-year flood) discharge. I further certify that the data submitted herewith in support of this request are accurate to the best
of my knowledge, that the analyses have been performed correctly and in accordance with sound
engineering practice, and that the proposed structural works are designed in accordance with
sound engineering practice.

June 3, 2016
Date

Craig A. Steward, P.E., CFM
Registered Professional Engineer
APPENDIX B—EXHIBITS
DEVEREUX CREEK FLOOD ANALYSIS

Appendix B
June 3, 2016

Appendix B

B.1 EXHIBITS

- Work Map
- Annotated Flood Insurance Rate Map (FIRM)
- Grading Plan (Progress Print Only)
- Bridge/Crossing Plans (Progress Prints Only)
ACCESS STRUCTURES

CROSSING LOCATION DESCRIPTIONS:
A. SIERRA-HAYNES CONCRETE CROSSING, 100' LONG CONCRETE WALKWAY WITH CRANKS
B. WHITE'S AREA CROSSING, 100' LONG TIMBER SEAMARKS ON CEM PILES
C. EASTERN ARM OF DEWEY'S ROUGH CROSSING, 20' LONG STEEL BRIDGE ON CEM PILES
D. PHILIPS AREA CROSSING, 100' LONG, STEEL BRIDGE ON CEM PILES
E. DEWEY'S SLOUGH OVERLOOK & VEHICLES PLATFORM, 100' x 25'2" OF STEEL ON CEM PILES
SIERRA MADRE CONCRETE CULVERT CROSSING
SCALE: 1" = 5'
CROSSING A

WHITTIER BOARDWALK CROSSING
SCALE: 1" = 5'
BRIDGE B

DEVEREUX BRIDGE CROSSING
SCALE: 1" = 10'
BRIDGE C

Profiles
OVERLOOK & VIEWING PLATFORM
DESIGNED BY OTHERS BASED ON PERFORMANCE SPECIFICATION
SCALE: 1"=5'
APPENDIX C– MT-2 FORMS
Appendix C

C.1 MT-2 FORMS

C.1.1 Devereux Creek Main Reach

C.1.2 Tributary 2

C.1.3 Tributary 3
A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☑ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or
proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood
elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

<table>
<thead>
<tr>
<th>Community No.</th>
<th>Community Name</th>
<th>State</th>
<th>Map No.</th>
<th>Panel No.</th>
<th>Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: 480301 480287</td>
<td>City of Katy, Harris County</td>
<td>TX</td>
<td>48473C</td>
<td>0005D</td>
<td>02/08/83</td>
</tr>
<tr>
<td>060331</td>
<td>Santa Barbara County</td>
<td>CA</td>
<td>06083C</td>
<td>1342G</td>
<td>12/4/201</td>
</tr>
<tr>
<td>060331</td>
<td>Santa Barbara County</td>
<td>CA</td>
<td>06083C</td>
<td>1361G</td>
<td>12/4/201</td>
</tr>
</tbody>
</table>

2. a. Flooding Source: Devereaux Creek

b. Types of Flooding: ☑ Riverine  ☐ Coastal  ☐ Shallow Flooding (e.g., Zones AO and AH)

☐ Alluvial fan  ☐ Lakes  ☐ Other (Attach Description)

3. Project Name/Identifier: NCOS Creek Restoration


5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☑ Physical Change  ☑ Improved Methodology/Data  ☑ Regulatory Floodway Revision  ☐ Base Map Changes

☐ Coastal Analysis  ☑ Hydraulic Analysis  ☐ Hydrologic Analysis  ☐ Corrections

☐ Weir-Dam Changes  ☐ Levee Certification  ☐ Alluvial Fan Analysis  ☑ Natural Changes

☐ New Topographic Data  ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.
b. The area of revision encompasses the following structures (check all that apply):

- Channelization
- Levee/Floodwall
- Bridge/Culvert
- Dam
- Fill
- Other (Attach Description)

6. Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☑ Yes   Fee amount: $6,500.00

☐ No, Attach Explanation


D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Craig A. Steward, P.E., CFM

Company: Stantec Consulting Services Inc.

Mailing Address:
111 E. Victoria Street, Santa Barbara, CA

Daytime Telephone No.: 805-308-9163
Fax No.: 805-966-9801

E-Mail Address: Craig.Steward@Stantec.com

Signature of Requester (required): Date:

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community’s review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA’s review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA’s process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official’s Name and Title: Community Name: Santa Barbara County

Mailing Address:
Santa Barbara County Flood Control Dist.
130 East Victoria Street, Suite 200

Daytime Telephone No.: 805-568-3440
Fax No.: 805-568-3434

E-Mail Address:

Signature of Requester (required): Date:

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) 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 statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier’s Name: Craig A. Steward, P.E., CFM

License No.: 37253
Expiration Date:

Company Name: Stantec Consulting Services Inc.

Telephone No.: 805-308-9163
Fax No.: 805-966-9801

Signature:
Date:
E-Mail Address: Craig.A.Steward@Stantec.com
Ensure the forms that are appropriate to your revision request are included in your submittal.

<table>
<thead>
<tr>
<th>Form Name and Number</th>
<th>Required if …</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒ Riverine Hydrology and Hydraulics Form (Form 2)</td>
<td>New or revised discharges or water-surface elevations</td>
</tr>
<tr>
<td>☒ Riverine Structures Form (Form 3)</td>
<td>Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam</td>
</tr>
<tr>
<td>□ Coastal Analysis Form (Form 4)</td>
<td>New or revised coastal elevations</td>
</tr>
<tr>
<td>□ Coastal Structures Form (Form 5)</td>
<td>Addition/revision of coastal structure</td>
</tr>
<tr>
<td>□ Alluvial Fan Flooding Form (Form 6)</td>
<td>Flood control measures on alluvial fans</td>
</tr>
</tbody>
</table>

Seal (Optional)
PUBLIC REPORTING BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 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, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, 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.

PRIVACY ACT STATEMENT


PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Devereaux Creek

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☑ Not revised (skip to section B) ☐ No existing analysis ☐ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

<table>
<thead>
<tr>
<th>Location</th>
<th>Drainage Area (Sq. Mi.)</th>
<th>Effective/FIS (cfs)</th>
<th>Revised (cfs)</th>
</tr>
</thead>
</table>

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model → Specify Model: ____________________________
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☐ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation.
B. HYDRAULICS

1. Reach to be Revised

<table>
<thead>
<tr>
<th>Description</th>
<th>Cross Section</th>
<th>Water-Surface Elevations (ft.)</th>
<th>Effective</th>
<th>Proposed/Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downstream Limit*</td>
<td>Pacific Ocean</td>
<td>100</td>
<td>16.5</td>
<td>14.58</td>
</tr>
<tr>
<td>Upstream Limit*</td>
<td>Phelps Road</td>
<td>1529</td>
<td>21.11</td>
<td></td>
</tr>
</tbody>
</table>

*Proposed/Revised elevations must tie into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS V5.0.1

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4. Models Submitted

<table>
<thead>
<tr>
<th>Models Submitted</th>
<th>Natural Run</th>
<th>Floodway Run</th>
<th>Datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate Effective Model*</td>
<td>Plan Name:</td>
<td>File Name:</td>
<td>Plan Name:</td>
</tr>
<tr>
<td>DevereauxMain 100yr</td>
<td></td>
<td></td>
<td>NAVD1988</td>
</tr>
<tr>
<td>Corrected Effective Model*</td>
<td>Plan Name:</td>
<td>File Name:</td>
<td>Plan Name:</td>
</tr>
<tr>
<td>DevereauxMain 100yr</td>
<td></td>
<td></td>
<td>NAVD1988</td>
</tr>
<tr>
<td>Existing or Pre-Project Conditions Model</td>
<td>Plan Name:</td>
<td>File Name:</td>
<td>Plan Name:</td>
</tr>
<tr>
<td>NCOSHydraulicEval Pre-Project v1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised or Post-Project Conditions Model</td>
<td>Plan Name:</td>
<td>File Name:</td>
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</tr>
<tr>
<td>NCOSHydraulicEval Post-Project v1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other - (attach description)</td>
<td>Plan Name:</td>
<td>File Name:</td>
<td>Plan Name:</td>
</tr>
</tbody>
</table>

* For details, refer to the corresponding section of the instructions.

☐ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A certified topographic work map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☐ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Aerial Topo and Surface

Source: Stantec Consulting Services Inc.  Date: March 2016

Accuracy: 1 ft.

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a copy of the effective FIRM and/or FBFM, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☐ Annotated FIRM and/or FBFM (Required)
### D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?  
   - Yes  
   - No  
   - a. For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
     - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
     - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.
   
   - b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA?  
     - Yes  
     - No  
     - If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill?  
   - Yes  
   - No  
   - If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised?  
   - Yes  
   - No  
   - If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

---

*Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.
A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)
   - ☒ Not revised (skip to section B)
   - ☐ No existing analysis
   - ☐ Improved data
   - ☐ Alternative methodology
   - ☐ Proposed Conditions (CLOMR)
   - ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

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<tr>
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</table>

3. Methodology for New Hydrologic Analysis (check all that apply)
   - ☐ Statistical Analysis of Gage Records
   - ☐ Precipitation/Runoff Model
   - ☐ Regional Regression Equations
   - ☐ Other (please attach description)

   Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

   If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transfer on Hydrology

   Is the hydrology for the revised flooding source(s) affected by sediment transport?  ☐ Yes  ☐ No

   If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation.
B. HYDRAULICS

1. Reach to be Revised

<table>
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<tr>
<th>Description</th>
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<th>Water-Surface Elevations (ft.)</th>
<th>Effective</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Downstream Limit*</td>
<td>Confluence with Devereaux Ck</td>
<td>300</td>
<td>7.77</td>
<td>8.12</td>
</tr>
<tr>
<td>Upstream Limit*</td>
<td>Phelps Road</td>
<td>7059</td>
<td>17.2</td>
<td>16.98</td>
</tr>
</tbody>
</table>

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS V5.0.1

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4. Models Submitted

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<th>Natural Run</th>
<th>Floodway Run</th>
<th>Datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duplicate Effective Model*</td>
<td>DevereauxTrib2</td>
<td><em>100yr</em></td>
<td>File Name:</td>
</tr>
<tr>
<td>Corrected Effective Model*</td>
<td>DevereauxTrib2</td>
<td><em>100yr</em></td>
<td>File Name:</td>
</tr>
<tr>
<td>Existing or Pre-Project Conditions Model</td>
<td>NCOSHydraulicEval</td>
<td>Pre-Project v1</td>
<td>File Name:</td>
</tr>
<tr>
<td>Revised or Post-Project Conditions Model</td>
<td>NCOSHydraulicEval</td>
<td>Post-Project v1</td>
<td>File Name:</td>
</tr>
<tr>
<td>Other - (attach description)</td>
<td></td>
<td></td>
<td>File Name:</td>
</tr>
</tbody>
</table>

* For details, refer to the corresponding section of the instructions.

[ ] Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A certified topographic work map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

[ ] Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Aerial Topo and Surface

Source: Stantec Consulting Services Inc. Date: March 2016

Accuracy: 1 ft.

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a copy of the effective FIRM and/or FBFM, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

[ ] Annotated FIRM and/or FBFM (Required)
D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?  
   □ Yes □ No
   a. For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
      • The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
      • The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.
   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA?  
      □ Yes □ No
      If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill?  
   □ Yes □ No
   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised?  
   □ Yes □ No
   If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.
PRIVACY ACT STATEMENT

A. GENERAL

Complete 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 Modeled Structure

1. Name of Structure: Bridge D
   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam
   Location of Structure: Tributary 2 near confluence with Devereaux Creek Main channel
   Downstream Limit/Cross Section: 85
   Upstream Limit/Cross Section: 128

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/detention 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 your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: Tributary 2 (aka Phelps Ditch)
Name of Structure: Bridge D

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

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/BASIN

Flooding Source: 
Name of Structure: 

1. This request is for (check one):  □ Existing dam/basin  □ New dam/basin  □ Modification of existing dam/basin

2. The dam/basin was designed by (check one):  □ Federal agency  □ State agency  □ Private organization  □ 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 _____________________________
   a. □ Local Government Dam  □ Private Dam
   Provided 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).

5. 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 a written explanation and justification for not using the critical duration storm.

6. 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?

7. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change?  □ Yes  □ No
   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

<table>
<thead>
<tr>
<th>FREQUENCY (% annual chance)</th>
<th>Stillwater Elevation Behind the Dam/Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FIS</td>
</tr>
<tr>
<td>10-year (10%)</td>
<td></td>
</tr>
<tr>
<td>50-year (2%)</td>
<td></td>
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<tr>
<td>100-year (1%)</td>
<td></td>
</tr>
<tr>
<td>500-year (0.2%)</td>
<td></td>
</tr>
<tr>
<td>Normal Pool Elevation</td>
<td></td>
</tr>
</tbody>
</table>

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):
      - upgrading of an existing levee/floodwall system
      - a newly constructed levee/floodwall system
      - reanalysis of an existing levee/floodwall system
   b. Levee elements and locations are (check one):
      - earthen embankment, dike, berm, etc.
      - structural floodwall
      - Other (describe):
      Station _____ to _____
   c. Structural Type (check one):
      - monolithic cast-in place reinforced concrete
      - reinforced concrete masonry block
      - sheet piling
      - Other (describe): ______
   d. Has this 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 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:

<table>
<thead>
<tr>
<th>Channel Station</th>
<th>Left or Right Bank</th>
<th>Opening Type</th>
<th>Highest Elevation for Opening Invert</th>
<th>Type of Closure Device</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

   (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 land side is: _____
   b. The maximum levee slope flood side 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

<table>
<thead>
<tr>
<th>Reach</th>
<th>Sideslope</th>
<th>Flow Depth</th>
<th>Velocity</th>
<th>Curve or Straight</th>
<th>Stone Riprap</th>
<th>Depth of Toedown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sta to</td>
<td></td>
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<td>Sta to</td>
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</tbody>
</table>

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

   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:
      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:
5. Embankment And Foundation Stability (continued)

<table>
<thead>
<tr>
<th>Case</th>
<th>Loading Conditions</th>
<th>Critical Safety Factor</th>
<th>Criteria (Min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>End of construction</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td>II</td>
<td>Sudden drawdown</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>III</td>
<td>Critical flood stage</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>IV</td>
<td>Steady seepage at flood stage</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>VI</td>
<td>Earthquake (Case I)</td>
<td></td>
<td>1.0</td>
</tr>
</tbody>
</table>

(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.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):  
   ☐ UBC (1988)  ☐ Other (specify):  

b. Stability analysis submitted provides for:  
   ☐ Overturining  ☐ 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:  
   ☐ 1%-annual-chance significant wave period:

   ☐ 1%-annual-chance significant wave height:  
   ☐ 1%-annual-chance significant wave period:

   ☐ 1%-annual-chance significant wave height:  
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   ☐ 1%-annual-chance significant wave period:

   ☐ 1%-annual-chance significant wave height:  
   ☐ 1%-annual-chance significant wave period:

   ☐ 1%-annual-chance significant wave height:  
   ☐ 1%-annual-chance significant wave period:
### E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability (continued)
   
e. Foundation bearing strength for each soil type:

<table>
<thead>
<tr>
<th>Bearing Pressure</th>
<th>Sustained Load (psf)</th>
<th>Short Term Load (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computed design maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum allowable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 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:
      □ Other (Describe): _____
      □ Foundation consolidation □ Embankment compression
   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.

   e. 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:
The number of pumps

<table>
<thead>
<tr>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

The ponding storage capacity

<table>
<thead>
<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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The maximum pumping rate

<table>
<thead>
<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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<tr>
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The maximum pumping head

<table>
<thead>
<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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</table>

The pumping starting elevation

<table>
<thead>
<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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<tbody>
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</table>

The pumping stopping elevation

<table>
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<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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Is the discharge facility protected?

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<th>Plant #1</th>
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Is there a flood warning plan?

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<th>Plant #1</th>
<th>Plant #2</th>
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How much time is available between warning and flooding?

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<tr>
<th>Plant #1</th>
<th>Plant #2</th>
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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.

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.

E. LEVEE/FLOODWALL (CONTINUED)
11. **Maintenance Plan**
   Please attach a copy of the formal maintenance 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 OF THE LEVEE DOCUMENTATION**

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 statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier’s Name: _____ License No.: _____ Expiration 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: _____

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.
**A. HYDROLOGY**

1. **Reason for New Hydrologic Analysis** (check all that apply)
   - [ ] Not revised (skip to section B)
   - [ ] No existing analysis
   - [x] Improved data
   - [ ] Alternative methodology
   - [ ] Proposed Conditions (LOMR)
   - [ ] Changed physical condition of watershed

2. **Comparison of Representative 1%-Annual-Chance Discharges**
   
<table>
<thead>
<tr>
<th>Location</th>
<th>Drainage Area (Sq. Mi.)</th>
<th>Effective/FIS (cfs)</th>
<th>Revised (cfs)</th>
</tr>
</thead>
</table>

3. **Methodology for New Hydrologic Analysis** (check all that apply)
   - [ ] Statistical Analysis of Gage Records
   - [ ] Precipitation/Runoff Model → Specify Model: ____________________________
   - [ ] Regional Regression Equations
   - [ ] Other (please attach description)

   Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. **Review/Approval of Analysis**
   
   If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. **Impacts of Sediment Transport on Hydrology**
   
   Is the hydrology for the revised flooding source(s) affected by sediment transport?  
   - [ ] Yes  
   - [ ] No

   If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation...
B. HYDRAULICS

1. Reach to be Revised

<table>
<thead>
<tr>
<th>Description</th>
<th>Cross Section</th>
<th>Water-Surface Elevations (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downstream Limit*</td>
<td>Confluence with Devereaux Ck</td>
<td>150</td>
</tr>
<tr>
<td>Upstream Limit*</td>
<td>Storke Road</td>
<td>1975</td>
</tr>
</tbody>
</table>

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS V5.0.1

3. Pre-Submittal Review of Hydraulic Models*

   DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4. Models Submitted

<table>
<thead>
<tr>
<th>Duplicate Effective Model*</th>
<th>Natural Run</th>
<th>Floodway Run</th>
<th>Datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Name: NA</td>
<td>Plan Name:</td>
<td>File Name:</td>
<td>Plan Name:</td>
</tr>
<tr>
<td>Corrected Effective Model*</td>
<td>NA</td>
<td>___________</td>
<td>__________</td>
</tr>
<tr>
<td>Existing or Pre-Project</td>
<td>NCOSHydraulicEval</td>
<td>Pre-Project v1</td>
<td>__________</td>
</tr>
<tr>
<td>Revised or Post-Project</td>
<td>NCOSHydraulicEval</td>
<td>Post-Project v1</td>
<td>__________</td>
</tr>
<tr>
<td>Other - (attach description)</td>
<td>File Name:</td>
<td>Plan Name:</td>
<td>File Name:</td>
</tr>
</tbody>
</table>

* For details, refer to the corresponding section of the instructions.

   ☑ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A certified topographic work map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

   ☑ Digital Mapping (GIS/CADD) Data Submitted (preferred)

   Topographic Information: Aerial Topo and Surface

   Source: Stantec Consulting Services Inc. Date: March 2016

   Accuracy: 1 ft.

   Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a copy of the effective FIRM and/or FBFM, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

   ☑ Annotated FIRM and/or FBFM (Required)
### D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?  
   ☐ Yes ☒ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations:**
      - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA?  
      ☐ Yes ☒ No

      If Yes, please attach **proof of property owner notification and acceptance (if available).** Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill?  
   ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised?  
   ☐ Yes ☒ No

   If Yes, attach **evidence of regulatory floodway revision notification.** As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

---

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.
A. GENERAL

Complete 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 Modeled Structure

1. Name of Structure: Bridge A
   Type (check one): □ Channelization ☒ Bridge/Culvert □ Levee/Floodwall □ Dam
   Location of Structure: Tributary 3 near Storke Road
   Downstream Limit/Cross Section: 1769  
   Upstream Limit/Cross Section: 1828

2. Name of Structure: Bridge C
   Type (check one): □ Channelization ☒ Bridge/Culvert □ Levee/Floodwall □ Dam
   Location of Structure: Midway between Storke Rd and Confluence with Devereaux Creek Main Channel
   Downstream Limit/Cross Section: 788  
   Upstream Limit/Cross Section: 841

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: Fill out one form for each flooding source studied.
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/detention 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 your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: Tributary 2 (aka Unnamed Channel)

Name of Structure: Bridge A and Bridge D

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

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/BASIN

Flooding Source: __________
Name of Structure: __________

1. This request is for (check one): ☐ Existing dam/basin ☐ New dam/basin ☐ Modification of existing dam/basin

2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☐ Private organization ☐ 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 _____________________________

   a. ☐ Local Government Dam ☐ Private Dam

      Provided 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? (must account for the maximum volume of runoff)
   ☐ 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/basin or downstream of the dam/basin change? ☐ Yes ☐ No
   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

<table>
<thead>
<tr>
<th>FREQUENCY (% annual chance)</th>
<th>Stillwater Elevation Behind the Dam/Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-year (10%)</td>
<td></td>
</tr>
<tr>
<td>50-year (2%)</td>
<td></td>
</tr>
<tr>
<td>100-year (1%)</td>
<td></td>
</tr>
<tr>
<td>500-year (0.2%)</td>
<td></td>
</tr>
<tr>
<td>Normal Pool Elevation</td>
<td></td>
</tr>
</tbody>
</table>

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

E. LEVEE/FLOO DWALL
1. **System Elements**
   
a. This Levee/Floodwall analysis is based on (check one):

   - [ ] upgrading of an existing levee/floodwall system
   - [ ] a newly constructed levee/floodwall system
   - [ ] reanalysis of an existing 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 reinforced concrete
   - [ ] reinforced concrete masonry block
   - [ ] sheet piling
   - [ ] Other (describe):  

   —

d. Has this 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 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:

<table>
<thead>
<tr>
<th>Channel Station</th>
<th>Left or Right Bank</th>
<th>Opening Type</th>
<th>Highest Elevation for Opening Invert</th>
<th>Type of Closure Device</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (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 land side is: ____
   b. The maximum levee slope flood side 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

<table>
<thead>
<tr>
<th>Reach</th>
<th>Sideslope</th>
<th>Flow Depth</th>
<th>Velocity</th>
<th>Curve or Straight</th>
<th>Stone Riprap</th>
<th>Depth of Toedown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sta</td>
<td>to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sta</td>
<td>to</td>
<td></td>
<td></td>
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<tr>
<td>Sta</td>
<td>to</td>
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<tr>
<td>Sta</td>
<td>to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

   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:
      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:
E. LEVEE/FLOODWALL (CONTINUED)

5. Embankment And Foundation Stability (continued)

<table>
<thead>
<tr>
<th>Case</th>
<th>Loading Conditions</th>
<th>Critical Safety Factor</th>
<th>Criteria (Min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>End of construction</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td>II</td>
<td>Sudden drawdown</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>III</td>
<td>Critical flood stage</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>IV</td>
<td>Steady seepage at flood stage</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>VI</td>
<td>Earthquake (Case I)</td>
<td></td>
<td>1.0</td>
</tr>
</tbody>
</table>

(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.

6. Floodwall And Foundation Stability


b. Stability analysis submitted provides for:  □ Overturining  □ 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.

<table>
<thead>
<tr>
<th>Loading Condition</th>
<th>Criteria (Min)</th>
<th>Sta</th>
<th>To</th>
<th>Sta</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overturining</td>
<td>Sliding</td>
<td>Overturining</td>
<td>Sliding</td>
<td>Overturining</td>
</tr>
<tr>
<td>Dead &amp; Wind</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead &amp; Soil</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead, Soil, Flood, &amp; Impact</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead, Soil, &amp; Seismic</td>
<td>1.3</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability (continued)
   e. Foundation bearing strength for each soil type:

<table>
<thead>
<tr>
<th>Bearing Pressure</th>
<th>Sustained Load (psf)</th>
<th>Short Term Load (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computed design maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum allowable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 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  □ No
   
   If No for any of the above, attach explanation.

   e. 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:
<table>
<thead>
<tr>
<th><strong>The number of pumps</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>The ponding storage capacity</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>The maximum pumping rate</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>The maximum pumping head</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>The pumping starting elevation</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>The pumping stopping elevation</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Is the discharge facility protected?</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th><strong>Is there a flood warning plan?</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
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<tr>
<th><strong>How much time is available between warning and flooding?</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
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<th><strong>Will the operation be automatic?</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
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<th><strong>If the pumps are electric, are there backup power sources?</strong></th>
<th>Plant #1</th>
<th>Plant #2</th>
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(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.

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**
   Please attach a copy of the formal maintenance 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.

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**CERTIFICATION OF THE LEVEE DOCUMENTATION**

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 statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier’s Name: ______ License No.: ______ Expiration Date: ______
Company Name: ______ Telephone No.: ______ Fax No.: ______
Signature: ______ Date: ______ E-Mail Address: ______

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**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.
Appendix D

D.1 FIELD PHOTOGRAPHS
Photo: 1 - Looking upstream from Marymount Way. Vegetation forms an open tunnel that shades the bottom and prevents for better flow characteristics.

Photo: 2 - Overbanks are generally open
Photo: 3-Overbanks are generally open.

Photo: 4-Looking upstream on Phelps Ditch from Phelps Road.
Photo: 5-Looking downstream at Phelps Ditch at Phelps Road

Photo: 6-Open area of Main Devereaux Channel at confluence with Phelps Ditch.
Photo: 7-Looking downstream from Venoco Crossing.

Photo: 8-Looking from east to west along Venoco Crossing.
Photo: 9-Looking upstream from Venoco Crossing

Photo: 10-Upstream side of Venoco Crossing
Photo: 11-Downstream side of Venoco Crossing (looking east).

Photo: 12-looking across the Devereaux Slough from the Venoco Crossing
Photo: 13-Deverezux Slough from Slough Road

Photo: 14-Looking upstream from downstream constriction.
Photo: 15-Downstream constricted channel.