

**OFFICE OF STRUCTURES
MANUAL ON HYDROLOGIC AND HYDRAULIC DESIGN**

**CHAPTER 5
PROJECT DEVELOPMENT**



April 6, 2016

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5.1 Introduction

This chapter describes the role of the Structure Hydrology and Hydraulics Division and its consultants in the project development process of the Office of Structures (OOS) where there are structures in floodplains. The process also applies to city or county projects that are constructed with Federal and State funds.

5.2 Background

The policies and procedures, as described in this chapter, are consistent with the regulations of the Federal Highway Administration as set for in the Code of Federal Regulations 23 CFR 650, Part A, Location and Hydraulic Design of Encroachments on Flood Plains.

This chapter focuses on the design aspects of OOS projects. The evaluation of environmental impacts and the preparation of environmental documents are handled by the Office of Planning and Preliminary Engineering (OPPE), and are accomplished before the design phase is initiated. The OOS is involved in this initial phase to the extent of cooperating with and providing assistance to the OPPE as they prepare the environmental documents. The OOS is also responsible to ensure that commitments contained in these environmental documents are incorporated in the design plans.

5.3 Permits

The preparation of necessary permits is also a part of the project development that is handled by the Office of Environmental Design (OED). There are two types of permits that are commonly required on design projects: permits for non-tidal waterways and permits for tidal waterways. The role of the OOS is one of cooperation and assistance with obtaining these permits. Discussion of permits in this chapter is limited to emphasizing the importance of completing this work at the proper time and in the proper sequence in the process.

5.4 Federal Emergency Management Agency (FEMA)

The National Flood Plain Insurance Program administered by FEMA has now become a primary factor to consider for OOS design projects in flood plains. The project development process discussed below has been greatly modified from the traditional process followed by the Structure Hydrology and Hydraulics Division (SHHD) in order to give full consideration to addressing the issues involved with the design and construction of structures affecting flood plains in the national flood plain insurance program.

5.5 Types of Projects

The Office of Structures is involved with the types of projects discussed below.

5.5.1 Preliminary Engineering and Planning Projects

Projects in the category are major highway projects such as Interstate highways on new location. The OOS is typically not involved in projects of this kind. When such studies are undertaken, a process will be established at that time to provide for appropriate review and coordination

throughout the planning, location and design phases of the project. Preliminary engineering and planning projects, therefore, are not discussed at greater length in this chapter.

5.5.2 Design Projects

Design projects of the OOS are undertaken for the preservation, maintenance and safety of the highway system, including bridge replacement and rehabilitation. Policy and Procedure Memorandum (PPM) OP-76-10G (Reference 1) of the OOS sets forth the formal review stages of design projects. While this PPM serves to outline the overall process of project development, it does not describe the tasks to be undertaken or reviewed by personnel of the SHHD. These tasks are discussed in the remaining sections of this chapter, and are outlined in Table 1 below which are applicable to all types of projects.

There are two major aspects to consider in establishing a project development plan for a design project: (1) whether the project affects a FEMA flood plain and (2) whether the structure can be constructed as an In-Kind or Out-of Kind Replacement (please see Section 5.5.2.3 for a definition of these terms).

Table 1 presents an overview of the steps or milestones that need to be taken during project development to address these two aspects. The Table also presents the milestones to be completed during the corresponding review stage in the Office of Structures design process, for example Pre-TS&L or TS&L. Also, each milestone is listed sequentially with respect to the order in which it is to be accomplished.

Table 1 Office of Structure Milestones

OFFICE OF STRUCTURES MILESTONES INVOLVEMENT OF THE STRUCTURES H & H DIVISION IN THE DEVELOPMENT OF DESIGN PROJECTS	
Pre-TS&L	
1.	Establish in writing design objectives and priorities; note any environmental commitments.
2.	Determine if project is located in a FEMA floodplain. If so, rerun and evaluate the FEMA model.
3.	Hold concept meeting. Determine In-Kind vs. Out-of-Kind design approach, seek preliminary approval from Deputy Director of OOS.
4.	Request Mapping and/or Surveys.
5.	Conduct hydrologic analyses. Obtain MDE approval of design discharges ⁽¹⁾
6.	Update the FEMA hydraulics model to meet SHA standards. ⁽²⁾
7.	Obtain FEMA/MDE concurrence ⁽¹⁾ , accept updated FEMA model as Existing Conditions model. ⁽²⁾
8.	Conduct Stream Morphology Studies: evaluate channel stability, obtain design information for hydraulics and scour studies. Evaluate Aquatic Organism Passage (AOP) constraints.
9.	Evaluate the need to redesign the road profile (AASHTO and/or design flow requirements) ⁽¹⁾ . Alternatively, obtain a design exception approval from the OOS Director.
10.	Develop proposed bridge/culvert design options; develop conceptual and subsequently semi-final designs for channel stability and AOP design (if applicable). Enter proposed design into the Existing Conditions model to create the Proposed Conditions model. ⁽¹⁾
11.	Develop preliminary scour study.
12.	Make presentations/obtain concurrence of environmental and regulatory agencies. ⁽¹⁾
13.	Obtain community concurrence for FEMA submission ⁽¹⁾ .
TS&L	
1.	Review the approved TS&L to confirm no changes are required in hydraulics model, or update the model as necessary. Discuss the acceptability of changes with FEMA/MDE reviewers; if changes are acceptable this now becomes the new effective FEMA/MDE model. ⁽¹⁾
2.	Prepare Hydraulics report and submit to MDE to obtain approvals. ⁽¹⁾
3.	Prepare FEMA Forms and CLOMR Application and submit to FEMA to obtain CLOMR. ⁽¹⁾
4.	Request Soil Borings. Continue Scour Studies using borings results.
5.	Develop maintenance of flow sequence during construction.
FOUNDATION REPORT	
1.	Complete scour studies, prepare Final Scour Report. ⁽³⁾
2.	Prepare recommendations for design of scour countermeasures as needed.
3.	Provide information for Joint Permit Application to OED.
STRUCTURAL REVIEW	
1.	Resolve any outstanding issues pertaining to scour and scour countermeasures design.
FINAL REVIEW AND PS&E (Design Plans)	
1.	Review design plans for consistency with MDE approved hydraulics model including temporary measures during construction. Prepare H/H Data Sheet.
ADVERTISE AND AWARD PROJECT	
1.	Confirm receipt of FEMA approval and MDE/COE permit. ⁽¹⁾
CONSTRUCT PROJECT	
1.	Obtain as built plans.
2.	Submit LOMR to FEMA. ⁽¹⁾

Notes to Table 1:

- 1) Not applicable to in-kind projects.
- 2) May not be needed; to be decided on a case by case basis
- 3) A stand - alone scour report that includes hydrology and hydraulics analyses.

5.5.2.1 Bridge Replacement or Improvement Projects with Highway and/or Channel Design.

Projects involve roadway improvements required due to the design storm criteria and/or safety and AASHTO requirements. This usually involves channel stability designs due to increases in shear stresses caused by the backwater reduction.

5.5.2.2 Bridge Replacement Projects without Highway and/or Channel Design

These projects do not require roadway improvements, structures could be in- or out- of -kind replacement design.

5.5.2.3 In-Kind Replacement Projects

Under certain conditions, a simplified hydraulic study may be acceptable for replacement of an existing structure. The project development process for an in-kind replacement structure is outlined below and described in more detail in Appendix 5A of this chapter.

There are three categories that are recognized as in-kind replacement:

5.5.2.3.1 Exact Replacement

Projects in this category produce a new bridge or culvert that is exact in all respects to the existing structure, and does not alter any characteristics of the area. If existing conditions indicate active scour or erosion, additional erosion protection may be included while retaining the “exact replacement” designation. Methods of installation and limits of erosion protection must be consistent with Best management Practices.

5.5.2.3.2 Structurally In-Kind Replacement

Frequently, an existing structure is not replaced exactly, but minor changes may be made to the size shape and location. Roadway profile and type of structure are unchanged. Active scour or erosion may be addressed as indicated under Exact Replacement.

5.5.2.3.3 Hydraulically In-Kind Replacement

In many instances, an existing structure is replaced with a different kind of structure, and other minor alterations may also be made. However, under flood conditions, the new structure may perform in the same or similar manner. Therefore, there is no significant change in the flood plain.

5.5.2.4 Rehabilitation and Deck Replacement Projects

Bridge rehabilitation and deck replacement projects typically do not involve the degree of study required for the design of a bridge as presented in Table 1 above. This is because such projects usually have negligible impacts to the stream and its flood plain, and create negligible changes to the hydraulic flow conditions at the structure. What will be needed to process a bridge rehabilitation or deck replacement project is a stand-alone scour evaluation study to document that the structure will remain stable for the design and check floods for scour. This may require that supporting hydrologic, hydraulic and stream morphology studies be included as a part of the scour evaluation report. Projects in this category include bridge/culvert extensions or widening, and they should be developed using the process outlined in Table 1.

5.6 Discussion of Table 1

Selected aspects of the project development process presented in Table 1 are explained in further detail below:

5.6.1 Pre –TS&L

The Structure Hydrology and Hydraulics Division (H&H Division) should become involved at an early date in all design projects containing structures in flood plains, starting with the initiation of project development and the formation of the Office of Structures (OOS) Project Team. Normally the H&H Team Leader will represent the Division on the OOS Project Team. The Team Leader needs to establish at an early date a perspective of the scope of the work, and the design objectives and priorities. This will normally include coordination with the Office of Environmental Design and a review of any environmental commitments that may have been made regarding the project.

Note: The above may or may not involve development of Pre-TS&L plans but in all cases H/H design Team Leader will seek the approval of the proposed structural options by the Director of OOS.

5.6.2 Preliminary hydrology and hydraulics studies

Preliminary hydrology and hydraulics studies are initiated by the SHHD Team Leader in order to decide whether the waterway opening of the existing structure meets current SHA design criteria. The return period of the design discharge should be determined from the functional classification of the highway on which the structure is located in accordance with the criteria set forth in Chapters 3, 8 and 10. The magnitude of the design discharge may be determined from previous hydrology or hydraulics studies conducted by SHA, FEMA, or other agencies; or from hydrologic analyses using the procedures set forth in Chapter 8, Hydrology.

5.6.3 Structure does not meet SHA design criteria,

If the structure does not meet SHA design criteria, the SHHD Team Leader will need to contact the District personnel (ADE for Maintenance or his/her designated rep) to establish if the frequency of flooding is of concern to the District. If yes, the full process outlined in Table 1 should be used. If not, the SHHD Team Leader should decide whether to follow the regular procedure for a replacement bridge, or to pursue a design exception in order to use the in-kind procedure. Factors to consider in weighing the merits of a design exception should include:

- Frequency of overtopping and resulting safety hazards and delays to traffic. This should include a determination of present and anticipated future ADT, and the type of service provided by the highway (school bus route, emergency evacuation route, etc.). It should also include consideration of the availability of alternative routes for detouring of traffic in the event the structure or highway is closed to traffic.
- Location and extent of the overtopping section(s) and whether it is practical and environmentally acceptable to upgrade the structure and the roadway approaches to meet the design criteria.
- Environmental impacts associated with designing the structure and its roadway approaches to meet current design criteria.

5.6.4 Design Exception

If the SHHD Team Leader wishes to pursue a design exception, such action will require the concurrence of the Division Chief, the OOS Deputy Director in charge of new design, and the approval of the Director, Office of Structures. If the design exception is not approved, the SHHD Team Leader will need to follow the steps for normal project development, including the evaluation of FEMA flood plains and detailed hydrologic and hydraulic studies, as set forth in Table 1.

5.6.5 Structure Design Acceptable to SHA

If the structure meets the SHA criteria for waterway adequacy, or if a design exception is approved by the Director, Office of Structures, reconfirm whether the proposed replacement structure meets the criteria established by the Maryland Department of the Environment (MDE) for in-kind replacement of Bridges and Culverts and proceed with the project development process.

5.7 Discussion on FEMA Coordination

The Team Leader will need to revisit the status of the remapping of FEMA flood plains as one of the first steps in the evaluation of NFIP (FEMA) flood plains using the guidance in the information below.

5.7.1 Flood Plains within the National Flood Plain Insurance Program (NFIP)*

(PLEASE NOTE: The following section has been excerpted from the previous version of the Manual. It will be submitted to FEMA and MDE for review and updating as needed)

Review applicable NFIP/MDE maps and ordinances to determine:

- Whether the floodplain is under the jurisdiction of the NFIP
- Whether a regulatory floodway has been established and, if so, the type of floodplain mapping:
 - Flood Hazard Boundary Map (FHBM)
 - Flood Boundary and Floodway Map (FBFM)
 - Flood Insurance Rate Map (FIRM)

To determine if a FEMA model is available for the floodplain affected by the highway project access MDE DFIRM Outreach web site (Ref. 6). The flood mapping related forms can be downloaded from the FEMA web site (Ref. 7). These forms can also be obtained by calling FEMA’s Map Assistance Center (Ref. 8)

NFIP regulations are published by the U.S. Government Publishing Office (Ref. 9)

5.7.2 Project is not within FEMA Flood Plain

The proposed crossing is not in a flood plain within the National Flood Plain Insurance Program (NFIP). Follow the Table 1 procedure while omitting the milestones referring to FEMA and NFIP flood plains.

5.7.3 No FEMA model available

The proposed crossing is in a flood plain within the National Flood Plain Insurance Program (NFIP), but no FEMA Model is available. In this case, The Team leader will need to contact FEMA/MDE liaison personnel to discuss how best to address the effect of the proposed project on the FEMA flood plain.

5.7.4 FEMA Model is available.

The proposed crossing is in a flood plain within the National Flood Plain Insurance Program (NFIP), and a FEMA Model is available. For this case follow the procedure in Table 1.

5.7.5 Summary of Required SHA Actions Regarding Highways and Structures in Floodplains under the Jurisdiction of the NFIP (Table 2)

Table 2 Required SHA Actions Regarding Highways and Structures in Floodplains

Type Of NFIP Flood Plain	Total Rise in Elevation of the Water Surface for the Base (100-Year) Flood	Required SHA Actions (See Notes below)
Regulatory Flood Plain	No increase in water surface	See Notes 1 and 2
	Some increase in water surface	See Notes 2 and 3
Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM)	Less than one-foot increase in water surface	See Notes 2 and 4
	Greater than one-foot increase in water surface	See Notes 2 and 5

Notes:

1. Send study results and highway/structure plans to the local community for their information
2. Provide for concurrent review of proposed work with FEMA, MDE and the local community. Document study results and local community concurrence in environmental MDE documents and Federal/State permit applications; send copies of these documents and applications to FEMA, MDE and the local community.
3. Revise regulatory floodway, notify affected property owners and/or take other actions as necessary to be consistent with the NFIP; submit to local community for written

concurrence and for any necessary map changes:

- where profile rise remains within surcharge limits, revision may be accomplished by changes in the table of water surface elevations
 - where profile rise exceeds surcharge limits, revision will normally necessitate changes to floodway boundaries and consideration of compensation to impacted parties
4. Notify local community that total rise in water surface is less than 1.0 foot: request written concurrence of proposed action.
 5. Notify local community that total rise in water surface elevation is greater than 1.0 foot; request written concurrence of proposed action; notify property owners.

References

- 1) Code of Maryland Regulations (COMAR)
http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.aspx
- 2) Code of Federal Regulations 23 CFR 650, Part A, Location and Hydraulic Design of Encroachments on Flood Plains.
- 3) Department of Natural Resources, Water Management Administration, Operational Policy 93-1 dated July 1, 1993 PPM OP-76-10 (G), Formal Review Stages of Projects, Office of Structures, Revised 10/8/86.
- 4) MDE DFIRM Outreach web site: <http://www.mdfloodmaps.net/dfirmimap/index.html>
- 5) FEMA: Flood mapping related forms and fees:
<https://www.fema.gov/flood-mapping-related-forms>
- 6) FEMA's Map Assistance Center at 1-877-FEMA MAP (1-877-336-2627).
- 7) Code of Federal Regulations 2002 Title 44, Vol. 1, Chapter I, subchapter B, Part 65 (<https://www.gpo.gov/fdsys/pkg/CFR-2002-title44-vol1/pdf/CFR-2002-title44-vol1-chapI-subchapB.pdf>)

APPENDIX A

Guidelines for In-Kind Replacement of Culverts and Bridges

The attached guidelines, prepared by the Maryland Department of Natural Resources, are provided for your use when considering an in-kind replacement of a bridge or structure. These guidelines, prepared in 1993, represent current DNR/MDE policy on this topic.

The user needs to make sure that a replacement-in-kind project meets the needs of the SHA, as discussed in Chapter 5, as well as the requirements of the DNR/MDE as set forth in this appendix.

Please note that SHA and MDE have agreed on the method of determining design discharges as discussed in Chapter 8, Hydrology, of this Manual.



Liam Donald Schaefer
Governor

Maryland Department of Natural Resources

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Torrey C. Brown, M.D.
Secretary

Robert D. Miller
Director

July 7, 1993

Mr. Hal Kassoff
Administrator
State Highway Administration
707 North Calvert Street
Baltimore, Maryland 21201

RE: In-Kind Replacement of Bridges & Culverts

Dear Mr. Kassoff:

Enclosed please find a detailed DNR-WRA Operational Policy explaining how the State's statutory and regulatory standards pertaining to waterway crossings can be met when such crossings are "in-kind" replacements of existing bridges and culverts. This policy was reviewed by the State Highway Administration and staff from ten county departments of public works and transportation.

This policy does not establish any new standards. It simply clarifies certain terms and explains the documentation necessary to demonstrate the "in-kind" nature of replacement structures. One of our objectives is to streamline WRA's review process for certain types of activities so that our staff can focus attention on proposed projects that are most likely to have significant waterway, floodplain and nontidal wetlands impacts.

Please note that authorization from WRA is still required for replacement bridges and culverts. In addition, temporary and permanent impacts to nontidal wetlands must be addressed. This policy should help SHA determine which projects do not require detailed hydrologic and hydraulic modeling, although in some instances rating curves may be necessary to demonstrate comparable hydraulic performance.

DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES ADMINISTRATION

OPERATIONAL POLICY

SUBJECT: In-Kind Replacement of Bridges and Culverts

DIVISION: Nontidal Wetlands & Waterways

POLICY NO.: 93-1

EFFECTIVE DATE: July 1, 1993

APPROVED: Robert D. Miller
Robert D. Miller, Esquire
Director

DATE: 6/22/93

I. BACKGROUND

Throughout Maryland, local governments and the State Highway Administration* are responsible for the safety of public roads, bridges and culverts. These agencies routinely inspect structures to assure that proper maintenance and repair are undertaken. Frequently, older structures are found to be unsafe or below required design standards and must be replaced.

II. PURPOSE

The purpose of this policy on replacement of existing bridges and culverts is to avoid complicated, expensive and time-consuming engineering analyses that may not be necessary. Having clear definition of the qualifying parameters will make it easier for applicants to certify compliance. Just as important, this policy will expedite WRA's review of floodplain impacts.

III. REVIEW BY THE DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR), Water Resources Administration (WRA) administers the State's regulatory programs for activities that impact water resources, including nontidal wetlands, wetlands buffers, and the 100-year floodplains along nontidal waters of the State. The primary purposes of a flood impact review are to assure that: (1) flood hazards are not increased; (2) activities are constructed to withstand the passage of the 100-year flood; (3) aquatic resources are adequately protected; and (4) stream degradation is minimized and scenic, wildlife and recreational functions are preserved.

* structure replacements by others may be handled in accordance with this policy with prior approval by the WRA.

- (1) ASSURE THAT FLOOD HAZARDS ARE NOT INCREASED. WRA typically requires applicants to submit evidence that activities do not change the predicted frequency and magnitude of flooding. Of greatest concern are sensitive floodplains where existing buildings are subject to flooding under current conditions. Activities in those floodplains are scrutinized very carefully, and detailed engineering analyses typically are required. Activities that increase flooding of existing structures are not permitted.

WRA also is charged with assuring that currently vacant or undeveloped land within the 100-year floodplain is not adversely impacted by proposed activities. Relatively small increases in predicted flood levels may be considered if all affected property owners accept the increase or if the additionally inundated area is purchased or placed in flood easement. Permits are issued if all other WRA issues have been addressed.

Activities that do not alter the frequency or magnitude of flooding are permitted if all other WRA issues have been addressed.

- (2) WITHSTAND PASSAGE OF 100-YEAR FLOOD. WRA's floodplain regulations require that applicants assure that their own activities are not subject to flood damage or that all practicable measures to reduce damage have been included. For public roads, bridges and culverts, standard designs typically take this into consideration since State and local governments wish to minimize loss of structures during floods. In practice, protection includes such measures as erosion protection and road profile design to minimize damage due to weir flow.
- (3) PROTECTION OF AQUATIC RESOURCES. With respect to public roads, bridges and culverts, three factors are critical for protection of aquatic resources. As a function of water use, instream construction is limited during certain times of the year in order to minimize adverse effects of sediment loading on aquatic species. At least one cell of all culverts is required to be installed 1 foot below the invert of the natural stream to assure adequate fish passage, to maintain the natural stream width, and to encourage deposition of sediment within the cell. Alternate fish passage measures may be acceptable with DNR-WRA's approval. Instream erosion protection (riprap, gabions, grout bags, etc.) must be designed and constructed to concentrate low flows. Methods of stream diversion used during construction must meet standards.

- (4) **PRESERVATION OF FUNCTIONS:** Projects must incorporate measures to prevent stream channel erosion and instability. Areas of active erosion may be protected within limits set forth in Best Management Practices. Temporary impacts to adjacent nontidal wetlands must be minimized, conducted, and restored in accordance with Best Management Practices. For new roads, bridges and culverts, alternatives that have fewer adverse environmental impacts may have to be considered.

IV. REPLACEMENT OF EXISTING STRUCTURES

Existing bridge and culvert structures may be replaced in a number of ways:

- (1) **EXACT REPLACEMENT.** These projects produce a new bridge or culvert that is exact in all respects to the existing structure, and does not alter any characteristics of the area. If existing conditions indicate active scour or erosion, additional erosion protection may be included while retaining the "exact replacement" designation. Methods of installation and limits of erosion protection must be consistent with Best Management Practices.
- (2) **STRUCTURALLY IN-KIND REPLACEMENT.** Frequently, an existing structure is not replaced exactly, but minor changes may be made to the size, shape and location. Roadway profile and type of structure are unchanged. Active scour or erosion may be addressed as indicated under Exact Replacement.
- (3) **HYDRAULICALLY IN-KIND REPLACEMENT.** In many instances, an existing structure is replaced with a different type of structure, and other minor alterations may also be made. However, under flood conditions the new structure may perform in the same or similar manner. Therefore, there is no significant change in the floodplain.
- (4) **STRUCTURALLY OR HYDRAULICALLY OUT-OF-KIND REPLACEMENT.** Many factors may result in replacement structures that are sufficiently different from existing structures that they must be considered as new bridges and culverts.

V. STREAMLINING WRA'S FLOODPLAIN IMPACT REVIEW

Under certain circumstances and with certification by the applicant, WRA's floodplain impact review of replacement structures can be expedited. In general, replacements that, through simplified analyses, are shown not to increase flood hazards need not be subjected to rigorous individual review.

Specific criteria for the categories of replacement have been defined:

- (1) EXACT REPLACEMENT. Application made through Regional Letter of Authorization (if appropriate) or separate submittal to WRA. Applicant commits to construction best management practices (BMPs) and other conditions necessary to minimize impacts on the waterway and aquatic resources, including minimization and restoration of temporarily disturbed nontidal wetlands. Applicant certifies replacement structure is exact in all respects, does not alter characteristics of the waterway, and retains or improves capability to assure passage of fish. Hydrologic and hydraulic analyses and floodplain impact review are not required.
- (2) STRUCTURALLY IN-KIND REPLACEMENT. Application made through Regional Letter of Authorization (if appropriate) or separate submittal to WRA. Applicant commits to construction BMPs and other conditions necessary to minimize impacts on the waterway and aquatic resources, including minimization and restoration of temporarily disturbed nontidal wetlands. Applicant certifies replacement structure is structurally in-kind, does not alter characteristics of the waterway, and retains or improves capability to assure passage of fish. Hydraulic analyses and floodplain impact review not required if applicant certifies the following:
 - (a) Roadway profile unchanged (unless demonstrated to be above the 100-year water surface elevation).
 - (b) Structure type effectively unchanged.
 - (c) Structure size and shape essentially unchanged; up to 10% change in waterway opening allowed if floodplain immediately upstream and downstream contains unimproved property, and if previous replacement did not entail reduction in opening.
 - (d) Proposed structure meets fish passage requirements.
 - (e) Location essentially unchanged; as a function of waterway size, slight shifts in location to improvement alignment may be allowed if floodplain immediately upstream and downstream contains unimproved property.
 - (f) If the floodplain immediately upstream or downstream contains improved property, changes in structure size, shape or location must be assessed to determine if the proposed structure is hydraulically in-kind.

- (3) HYDRAULICALLY IN-KIND REPLACEMENT. Application made through Regional Letter of Authorization or separate submittal to WRA (if mitigation of permanent nontidal wetlands loss required). Applicant commits to construction BMPs and other conditions necessary to minimize impacts on the waterway and aquatic resources. Replacement structure may not alter the characteristics of the waterway, and retains or improves capability to assure passage of fish. Increase in overall footprint may require mitigation of permanent nontidal wetland losses. Detailed hydrology not required. Hydraulic analyses required to demonstrate closeness of hydraulic performance (rating curves) for existing and replacement structures. Adequate range of discharges required to assess performance under low flow, pressure flow, weir flow, etc. Applicant certifies the following:
- (a) Roadway profile essentially unchanged (unless demonstrated to be above 100-year water surface elevation). Changes must be adequately reflected in hydraulic analysis.
 - (b) Location essentially unchanged.
 - (c) Proposed structure meets fish passage requirements.
 - (d) Increase in footprint, type and areal extent of nontidal wetlands impacted, if applicable.
 - (e) Compliance with mitigation requirements, if applicable.
 - (f) If the floodplain immediately upstream and downstream contains only unimproved property and rating curve for replacement structure indicates no more than 0.5' increase in water surface elevation for range of discharges, no hydrology required.
 - (g) If the floodplain immediately upstream and downstream contains only unimproved property and rating curve for replacement structure indicates more than 0.5' but less than 1.0' increase in water surface elevation for range of discharges, no hydrology required. Affected property owners must be notified of increase by certified mail.
 - (h) If the floodplain immediately upstream contains improved property and rating curve for replacement structure indicates no more than 0.1' increase in water surface elevation for range of discharges, no hydrology required.

VI. CONDITIONS REQUIRING FULL ANALYSIS:

(1) STRUCTURALLY OR HYDRAULICALLY OUT-OF-KIND REPLACEMENT

Any bridge or culvert replacement that fails to meet the in-kind replacement criteria may be subject to complete analysis. Complete analysis refers to determination of discharges for the 2-, 10- and 100-year frequency flood events, and preparation of hydraulic modeling to determine the impact of the proposed structure. In limited circumstances, WRA may concur with selection of a range of discharges.

(2) IN-KIND REPLACEMENT DOES NOT APPLY UNDER CERTAIN CIRCUMSTANCES

This policy may be applied only in situations where unusual conditions or circumstances are not present. It shall not be used for replacement of structures that are: (1) part of a dam embankment; (2) designed for stormwater management purposes; or (3) functioning as a dam, whether by design or unintentionally. Applicants are urged to consult with WRA if any unusual conditions exist to determine if application of this policy is acceptable.

VII. SELECTION OF AN APPROPRIATE RANGE OF DISCHARGES

The range of discharges to be included in a hydraulic performance evaluation should include low flow, pressure flow, inlet and outlet control, and weir flow. However, it is also important to avoid using extraordinarily high values simply to include weir flow. For example, it may be unreasonable to evaluate weir flow for a culvert with high road profile, if the drainage area is relatively small.

Applicants must explain the rationale for selection of the upper limit of the range discharges. Where available, discharges from FEMA's Flood Insurance Rate studies may be acceptable for existing watershed development conditions. Under other circumstances, it may be reasonable to use USGS Regression Equations to estimate the 100-year discharge. To address regulatory requirements pertaining to ultimate development and to be conservative, an adjustment factor of up to 50% of the estimated 100-year discharge will be required. Alternatively, the USGS 100-year discharge plus 2 standard deviations may be acceptable.

VIII. DEFINITION OF "IMMEDIATELY UPSTREAM OR DOWNSTREAM"

The reach of stream that is potentially impacted by floodplain obstructions cannot be defined readily without sophisticated analysis. Parameters that may be important include channel slope, waterway opening, velocity, channel and overbank roughness, and magnitude of the encroachment.

This policy does not establish rigid standards for determining the length of reach up or downstream of a replacement structure that must be evaluated for potential impact on adjacent properties. It is incumbent on the applicant's prudent exercise of engineering judgement to ensure and demonstrate that an adequate reach has been considered.

IX. DEFINITION OF "UNIMPROVED PROPERTY" AND "IMPROVED PROPERTY"

For the purposes of this policy, "unimproved property" refers to property, or portions thereof, on which there are no structures or buildings. Lands that have been altered or enhanced without buildings, for example by landscaping, retaining walls, minor sheds, livestock feeding sheds, etc., are considered to be unimproved property.

For the purposes of this policy, "improved property" refers to property, or portions thereof, on which there are walled and roofed buildings and structures. The term "structures" refers to improvements other than buildings, such as storage tanks.

end