

<i>D</i> rainage	<i>Chapter</i> STORMWATER & FLOODPLAIN MANAGEMENT
	<i>Subject</i> General

**DR 201-1 INTRODUCTION**

Floodplain Management and Stormwater Management are somewhat intertwined. Floodplains are usually thought of as areas adjacent to large streams but may include ditches in urban areas and ponding areas. Stormwater is often associated with drainage conveyance systems such as small pipes or streams. While stormwater management is a very comprehensive subject that covers a wide variety of topics, floodplain management is much narrower in scope and deals primarily with reducing flood hazards.

**DR 201-2 Flood Hazards**

Before any highway development, analyze existing and post-developed flood flow characteristics at highway related stream crossings and drainage conveyance systems to determine their effects upon the highway and adjacent properties. Document changes to the pre-existing flood hazards from the alternates studied. Include effects to private property both upstream and downstream including overtopping floodwaters diverted onto previously unaffected property.

**DR 201-3 Interagency Coordination**

Coordination between concerned agencies is required during the project planning and preliminary line & grade phases of the project. Because the location of the facility is being determined during the preliminary line & grade phase, a significant amount of coordination will be necessary during this phase. Substantial cost savings and other benefits frequently can be realized for highway and water resource projects through coordinated planning among the Federal, State, and local agencies that are engaged in water-related activities (such as flood control and water resources planning). Interagency cooperation, through the Area Development District (ADD) offices, etc., is an essential element for serving the public interests.

The term local community is mentioned frequently in this chapter. The local communities, specifically their municipal governments, are left with the burden to deal with water quality and quantity issues long after public works projects are completed. It is imperative to get input from these communities into the design process.

Early planning and location studies should be coordinated within the Department so duplication of effort is minimized and all those who might be involved in future project work will be informed of any ongoing studies and study results.

**DR 201-4      Legal Aspects**

Detailed legal aspects related to drainage are referred to the Legal Council. The following generalizations, given in Chapter V of the Highway Drainage Guidelines by AASHTO (2006) should be considered:

- A goal in highway drainage design should be to perpetuate natural drainage, insofar as practical.
- The courts look with disfavor upon infliction of damage that could reasonably have been avoided, even where some alteration in flow is legally permissible.
- The basic laws related to the liability of governmental entities are undergoing radical change, with a trend toward increased governmental liability.
- Drainage laws are also undergoing change, with the result that older and more specific standards are being replaced by more flexible standards that tend to depend on the circumstances of the particular case.

In water law matters, designers should recognize that the State is generally held to a higher standard than a private citizen. This is true though the State should be granted the same rights and liabilities, since no law says differently. In general, designers should not address a question of law without the aid of legal counsel. Whenever drainage problems are known to exist or can be identified, drainage and flood easements or other means of avoiding future litigation should be considered, especially in locations where a problem could be caused or aggravated by the construction of a highway.

It is often helpful in the planning and location phase of a project to document the history and present status of existing conditions or problems, and supplement the record by photographs and descriptions of field conditions. Such thoroughness is essential, because the Department may be blamed for flooding or erosion damage caused by conditions that existed before highway construction.

**DR 201-5      Permits**

Specific Federal, State, and local permits that will be needed for a highway project must be identified in the environmental document early in the planning stages. For Federal permits, applications should be filed with the Coast Guard for the construction of bridges on Navigable streams, and with the Corps of Engineers for other construction.

Before initiating design work, the designer must review the environmental document with the appropriate Central Office Personnel to identify regulatory commitments, constraints, and any permits required. Permits, as required, should be obtained before construction begins, and preferably before detailed

plans are prepared. A list of the major categories of applicable water related permits are given below:

- KPDES stormwater discharge permit for construction projects, (See Drainage Chapter DR 1000 "Erosion Control"
- United States Army Corps of Engineers Section 404 Permits (Nationwide and/or Individual), (See HD 504 of the Highway Design Manual and DR 500, 600, & 800 of the Drainage Manual)
- Kentucky Natural Resources and Environmental Protection Cabinet, Division of Water, Section 401 Water Quality Certification (See HD 504 of the Highway Design Manual and DR 500, 600, & 800 of the Drainage Manual)
- Navigation clearances; Coast Guard, TVA. (See DR 800 of the Drainage Manual)

In addition to the above permits, coordination is necessary with the following local agencies when projects are located in their jurisdictions: Metropolitan Sewer District (MSD), Lexington Fayette Urban County Government (LFUCG), or any other local governments that have specific drainage criteria. (See MS4 Section DR 202-10).



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**DR 202-1 PLANNING**

The Kentucky Department of Highways often is and should be perceived as a developer of transportation facilities that has the potential to stimulate secondary activity along the transportation corridor, just as a major residential development can stimulate commercial activity. Secondary activity must be anticipated during the planning phase to address the overall stormwater management needs with other utilities such as water, wastewater, and power. Because the transportation corridor often traverses several watersheds, the development of an adequate stormwater management plan can be severely fragmented and significant problems may result if there is a lack of coordinated planning among concerned parties.

To be truly effective, a stormwater management plan should consider the total scope of development (i.e., transportation, residential, commercial, industrial, and agricultural). **Department coordination with responsible local agencies is essential to assure that proposed facilities are compatible with the long-term water quality and flooding related needs of the area.** The Highway Department can provide important information to local agencies wishing to develop a comprehensive stormwater management plan without assuming responsibility for the planning and decision-making process for the entire watershed.

Before designing, a level of planning should be undertaken that would properly locate facilities and adequately address local concerns, permitting requirements, legal considerations, and other potential problems. The “Stormwater Management” section of this chapter provides general guidelines and major considerations for evaluating these factors during the planning and location process. The important point to emphasize is that the designer should become involved in the early stages of project development and not wait until the later design stages.

**DR 202-2 WATER QUALITY ISSUES**

The issues that stormwater management are intended to address can be categorized as water quality or water quantity issues. Water quality issues deal with the degradation of runoff, and the protection of environmental resources. Planning for drainage and stormwater management facilities should include a consideration of the potential problems associated with stormwater quality. The

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following general rules should be followed:

- maximize stable open channels
- maximize use of vegetated linings
- minimize curb and gutter sections and their associated storm sewers
- minimize culvert lengths

### **DR 202-3 WATER QUANTITY ISSUES**

Determinations of stormwater quantity are primarily useful for evaluating and mitigating the impact of a project from a flooding perspective. Land development can increase peak runoff rates and volumes from storm events which can lead to higher flood elevations in the absence of detention ponds (basins, storage areas). Appropriate hydrologic and hydraulic calculations presented in various chapters of this manual should be made to determine the required conveyance through the highway right-of-way and to aid in mitigating impacts to downstream property owners.

### **DR 202-4 GENERAL GOALS OF DRAINAGE FACILITY DESIGNS**

Procedures contained in this manual should be used to evaluate the ability of a facility to accomplish the following goals for a particular area:

- Reduce runoff rates by increasing infiltration, and by storing precipitation and runoff where it falls by releasing them slowly.
- Protect areas subject to flood damages by keeping runoff confined to drainage facilities such as pipes or channels and by building appropriate flood control facilities.
- Minimize the degradation of water quality
- Protect special environmental resources
- Keep flood plain encroachment outside the limits of regulated floodways.

### **DR 202-5 STORMWATER DISPOSAL**

The following evaluations should be made when selecting the plan for disposal of stormwater runoff:

- Assess the capacity/adequacy of existing drainage systems.
- Assess the compatibility of design discharges with adopted drainage plans and regulatory criteria.
- Assess the potential need for retention or detention storage areas to mitigate the impacts of increased runoff if the increase cannot be handled by other project features.
- Assess the availability of right-of-way to construct a retention or detention pond within or outside the right-of-way. Determine the availability of alternative sites for storage of stormwater.
- Identify any unusual groundwater or soil conditions such as impermeable soil layers and locate the water table.

- Identify any jurisdictional, permit or economic restrictions.
- Identify any unusual site conditions (e.g., woods, wetlands, or other environmental features that might influence the development of a stormwater management system).
- Identify karst drainage features and evaluate their capacity to convey runoff.

**DR 202-6 CONSTRUCTION CONSIDERATIONS**

Many serious construction problems arise because important drainage and water-related factors were overlooked or neglected in the planning and location phases of the project. With proper planning, many problems can be avoided or cost effective solutions developed to prevent extended damages. Such problems include but are not limited to:

- soil erosion,
- sediment deposition,
- drainage and landslide,
- sinkholes and karst areas,
- timing of project stages,
- protection for aquatic habitat,
- protection of streams, lakes, and rivers, and
- protection of wetlands,
- temporary drainage measures.

Analysis of available data, proper scheduling of work, and other aspects involved in the early planning and location studies can alleviate many problems encountered in the construction of drainage facilities.

**DR 202-7 MAINTENANCE CONSIDERATIONS**

Planning and location studies should consider potential erosion and sedimentation problems upon completion of highway construction. If a particular location will require frequent and expensive maintenance due to drainage, alternate locations should be considered unless the potentially high maintenance costs can be reduced by special design. Experience in the area is the best indicator of maintenance problems and interviews with maintenance personnel could be extremely helpful in identifying potential drainage problems. Reference to highway maintenance and flood reports, damage surveys, newspaper clippings and interviews with local residents could be helpful in evaluating potential maintenance problems.

Channel changes, minor drainage modifications and revisions in irrigation systems usually carry the assumption of certain maintenance responsibilities by the department constructing the highway. Potential damage from the erosion and degradation of stream channels and problems caused by ice and debris can be of considerable significance from the maintenance standpoint.

**DR 202-8 ENVIRONMENTAL CONSIDERATIONS**

Environmental studies will be performed for all projects. These studies will be initiated by the Division of Environmental Analysis (DEA) and will comply with all Federal, State, and local laws and regulations related to environmental quality. Use these studies to determine special water quality requirements that may be needed for the drainage design.

Environmental impacts should be documented for each alternate receiving consideration. Encroachments onto adjacent environmentally sensitive areas should be avoided whenever possible. Identifying environmental considerations early in the planning process can prevent major implementation problems as the design and construction of the project proceeds.

**DR 202-9 NPDES**

In 1972, amendments made to the Clean Water Act created the National Pollution Discharge Elimination System (NPDES). This program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Over the years point discharges have been defined to include many types of discharges. Included in these discharge are construction runoff and runoff from storm drainage systems.

Under the program, states that meet certain criteria have the authority and responsibility to regulate discharges into these waters. In Kentucky this authority and responsibility lies with the Division of Water (DOW) in the Environmental and Public Protection Cabinet. The DOW regulates these discharges under Kentucky's version of the NPDES, the Kentucky Pollution Discharge Elimination System (KPDES).

A discussion of the KPDES program as it relates to erosion control can be found in Chapter 10 "Erosion Control" of this manual.

**DR 202-10 MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)**

Under the KPDES umbrella is a program called the Municipal Separate Storm Sewer System (MS4). The MS4 program in Kentucky is promulgated under KRS 224 and 401 KAR Section 5. As defined in 401 KAR 5:002, Section 1(184), a municipal separate storm sewer system is defined as:

*"a conveyance, or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains:*

*a) owned or operated by a state, city, town, county, district, association or other public body....having jurisdiction over disposal of ...storm water.....that*

- discharges to waters of the Commonwealth;*
- b) designed or used for collecting or conveying storm water;*
  - c) which is not a combined sewer;*
  - d) which is not part of a publicly-owned treatment works (POTW)."*

The Federal EPA has categorized MS4s into three (3) categories: small, medium and large. The program essentially gives the local communities the responsibility of assuring that their drainage systems meet certain water quality criteria.

As of the publication date of this manual, the Cabinet was listed as a co-permittee with 43 municipalities. Specific goals are outlined for the MS4 program. In most cases the cabinet is the "Cooperating Party" with the local community designated as the "Responsible Party." As quoted in the permit documents: "The Cooperating Party has a duty to fully cooperate with the Responsible Party." Drainage designs that are located in these MS4 jurisdictions should consider following any local regulations that may apply. Each district has an MS4 coordinator that can get the designer in contact with the proper authorities.

The Division of Water website <http://www.water.ky.gov/> contains more information on the KPDES and MS4 programs.

The Kentucky Transportation Cabinet's Division of Environmental Analysis website located at <http://transportation.ky.gov/EnvAnalysis/default.asp> contains additional information on these topics as well.

#### **DR 202-11 POST CONSTRUCTION BEST MANAGEMENT PRACTICE (BMP)**

The term Post Construction Best Management Practice is a term used to define a group of design and construction techniques that are intended to address water quality and quantity issues for several years after the construction of a project. Unlike the BMPs developed from the Erosion Control Plan (See Chapter DR 1000 of this manual), Post Construction BMPs will remain in place long after the construction of the project is complete.

**Local communities may be required to include these BMPs into their drainage systems, as a result of their MS4 programs. Designers should consider accommodating these requirements where possible.**

Maintenance of post construction BMPs is a significant issue. The most feasible solution to this problem is to develop agreements with the local communities to maintain these structures. In cases where no agreements with the local communities can be reached, Cabinet's Division of Maintenance should be consulted to determine the Cabinet's ability to maintain these structures.

#### **DR 202-12 VEGETATED CHANNELS**

Perhaps the most cost effective post construction BMP is the vegetated channel. Certain biological and physical characteristics of vegetated channels make them capable of pollutant removal. The vegetation acts a filter for water flowing



through the channel. The roughness of the vegetation can also decrease velocities so that particulate matter settles out. Vegetated channel can be made even more effective if they are shaped into swales. Swales are merely gradual depressions that have widths that are much greater than their depth. Obviously, swales will not have a significant hydraulic capacity. These swales will be ineffective in area with large peak flows.

In areas where shear stresses are too large for vegetation, Turf Reinforcement Mats can be used to strengthen the vegetation. Turf Reinforcement Mats are discussed further in Chapter DR 500 "Open Channels" of this manual.

### DR 202-13 DRAINAGE TO SIGNIFICANT RESOURCES

The BMP described here is to be used in locations where drainage is released to a significant resource. This BMP is to remain in place after construction of a project thus allowing it to serve as an erosion control measure during construction, and to serve as a post construction BMP for water quality after project completion.

This BMP is required for all roads listed on the National Highway System located in Karst areas and on all roadways which may impact a significant resource as determined by the DEA. A map of the National Highway System is located on the Division of Planning website at the following web address: [http://transportation.ky.gov/planning/maps/NHS/nhs\\_kysz\\_2005.pdf](http://transportation.ky.gov/planning/maps/NHS/nhs_kysz_2005.pdf)

A significant resource may include but is not limited to:

- aquatic habitat
- wetlands
- water supply watersheds
- wild rivers
- critical resource waters
- impaired waters
- karst areas

For drainage that meets the above criteria, the following guidelines apply.

1. Use naturally occurring vegetated channels or newly constructed grass swales for ditches carrying runoff to the significant resource. Do not disturb naturally vegetated channels that are not planned for reconstruction or re-grading. Instead, use these channels to convey roadway drainage if possible.
2. If constructed channels are necessary to carry roadway drainage, use grass lined swales. These swales shall be constructed with a flat bottom cross-section of 2 ft. minimum. The width of the bottom of the swale will be determined by the Design Engineer based on the expected peak flow and the slope so that resulting shear stress will allow as much grass as possible. Turf Reinforcing Mat should be used to strengthen the vegetation where shear stresses are too high for vegetation alone. See DR 500 "Open Channels" for more information. Channels requiring Turf Reinforcing Mat shall be

constructed as per Special Note 11F "Special Note for Turf Reinforcing Mat" in the Standard Specifications for Road and Bridge Construction.

3. Use interceptor ditches to prevent large volumes of off site water from adding to the volume of run-off being carried by the swales.
4. Use containment basins to temporarily impound the run-off from the swales before it is discharged from the right-of-way or into a significant resource. These basins shall have a minimum volume of 10,000 gallons (1,337 cubic feet) and should be located just upstream from each final discharge point to a significant resource. This volume may be attained by constructing basins in series if necessary. The discharge point of each basin shall be constructed as a Silt Trap Type B (See Standard Drawing RDX-225). Containment basins shall be designed to maximize the flow length between the entrance and exit.
5. Provide notes in the plans indicating that when and if these swales and/or basins are cleaned out, they shall be restored.
6. Where possible, provide at least 150' of naturally occurring vegetated channel or grass swale before water is released to the protected resource.

#### DR 202-14 KARST CONSIDERATIONS

It is estimated that 55% of Kentucky is underlain by rocks that have the potential for karst development. The Kentucky Geological Survey has performed a significant amount of research on karst. Their website contains a map of karst areas in Kentucky. This map can be found at [http://kgsweb.uky.edu/olops/pub/kgs/mc33\\_12.pdf](http://kgsweb.uky.edu/olops/pub/kgs/mc33_12.pdf)

Drainage in karst topography often requires the use of sinkholes as drainage outlets. Sinkholes used as drainage outlets require special consideration due to several factors:

- Sinkholes are unreliable drainage outlets and often experience collapse or other problems in subterranean areas that may be inaccessible or out of government jurisdiction
- The amount of water that a sinkhole can accept is dependant on the size of the underground conduit system and the stage of the groundwater table below the sinkhole
- Sinkholes that are located out of governmentally controlled land are susceptible to infill by private land owners
- Sinkholes provide a direct discharge to groundwater sources without the benefit of infiltration of the water through the soil layers above the groundwater
- The ecosystems that exist in the underground streams below a sinkholes are highly sensitive to changes in water quality

Because of the issues listed above, the best option is to avoid karst elements altogether. Early alignment development should consider the location of individual karst elements such as sinkholes and strive to avoid impacting them.

When impacts to karst elements are unavoidable, the following considerations must be addressed:

- Water Quality BMP's
- Matching Proposed and Existing Hydrologic Conditions
- Potential Flood Hazard
- Stabilization

These considerations are discussed individually below.

#### **WATER QUALITY BMP'S**

Because of the potential affect to groundwater sources, the drainage above all sinkholes encountered on a highway project should provide adequate water quality measures. This includes erosion control procedures to minimize sediment entering the sinkhole and post construction BMP's to enhance water quality after the road is constructed. The BMP outlined in DR 202-13 should be applied to drainage contributing to a sinkhole.

There may be instances when the swale/containment BMP described in DR 202-13, is not adequate to filter runoff. Examples of this would include instances where the project runoff cannot be contained in a swale or lack of room to construct the swale containment system. In this case encircle the sinkhole with a permanent rock check to filter runoff before it enters the sinkhole.

#### **MATCHING PROPOSED AND EXISTING HYDROLOGIC CONDITIONS**

Often existing drainage patterns are such that runoff is routed to sinkholes. Sinkholes are not a predicable runoff conveyance structure. The runoff to sinkholes should be limited to the existing flowrates and volumes. Routing additional watershed area to sinkholes should be avoided.

#### **POTENTIAL FLOOD HAZARD**

Evaluating the projects potential to aggravate any flooding to the road or surrounding property is essential when dealing with sinkholes. The first step in this evaluation is to determine the storage capacity provided by the topography above the sinkhole. The capacity calculation is performed by calculating the total runoff volume to the sinkhole in question for the 100 year, 3 hour storm. This volume can be estimated via the following equation:

#### **Equation 202-1, Sinkhole Storage Volume**

$$V = CRA$$

Where: V = Volume of Runoff, Acre-Ft  
C = Runoff Coefficient (See DR 403-2)  
R = 100 year, 3 hour rainfall depth, feet (Approximately .33 feet)  
A = Drainage Area, Acres

The elevation and lateral limits of ponding water around the sinkhole must be

determined using the volume calculated in Equation 201-2 and by assuming the sinkhole has no draining capacity.

A comparison of the existing conditions to the proposed conditions imposed by the project is then performed. Changes to limits of the ponding water must be evaluated. The two primary ways a project could affect this volume are by changing drainage patterns to the sinkhole or encroaching on the storage capacity. If the ponding limits for the proposed conditions calculated above:

- flood the road or adjacent property;
- overflow to another drainage basin that cannot handle the runoff;
- or increase by more than 1' over existing conditions;

Consider the following mitigation measures:

- Purchase area around the ponding limits in fee simple or permanent drainage easement. This will ensure that KYTC can keep the sinkhole open to accept drainage.
- Route water to another drainage basin. Care must be taken to ensure that the other drainage basin can accept the runoff.
- Excavate around sinkhole to increase its storage capacity.

#### **STABILIZATION**

Many sinkholes are unstable due to erosive forces of runoff entering the sink. If it is determined that this instability will have impacts on the road facility, it shall receive additional treatments.

The Geotechnical Branch will locate and drill sinkholes as a part of their geotechnical investigations. Because the drainage engineer will be closely examining project mapping to determine drainage patterns, he or she will have an understanding of the topography. The drainage engineer should investigate any depressions exhibited in the mapping to determine if there are open sinkholes. Secondly the drainage engineer should ensure that these sinkholes have been identified and drilled in the geotechnical investigation.

Once sinkholes are located and drilled, the drainage engineer and the Geotechnical Branch must determine if these sinkholes are needed for drainage. Using this information and the geotechnical investigation results, a plan to stabilize the sinkholes must be developed and indicated on the plans.

Standard Drawing Sepia 003 "Treatment of Open Sinkholes" depicts the various treatment options to stabilize a sinkhole. Section 215 of the Standard Specifications for Road and Bridge Construction discusses the construction requirements for treatment of sinkholes.

#### **DR 202-15 WETLANDS**

Executive Order 11990, May 24, 1977, (23 CFR 771) orders each Federal agency to:

- take action to minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values to wetlands;
- avoid undertaking or providing assistance for new construction in wetlands unless findings indicate that there is no practicable alternative and all practicable measures are taken to minimize harm which may result from the action; and
- Consider factors relevant to the proposal's effects on the survival and quality of the wetlands.

See HD 400 & 500 of the Highway Design Manual for more information on wetlands.

#### **DR 202-16 OUTLET CAPACITY**

Newly constructed highway drainage systems have to be tied into an existing channel or storm sewer network. It is imperative that the designer determine the capacities of these existing systems. This may require obtaining information on the existing system for a significant distance downstream.

Another important consideration in designing drainage systems is to return drainage patterns back to their original conditions. Taking a watershed and routing it to a location that is different than existing drainage patterns should be avoided, unless it fits the community's storm water plan, or is the only feasible alternative. The overall community stormwater plan should be considered and plans should be made available to the regulators for comment. The communities' regulations may address issues relating to outlet capacity.

#### **DR 202-17 DETENTION / RETENTION STORAGE**

Detention and/or retention basins can be used to store stormwater and release it at slower rates. Generally, post development discharges will be limited to their pre development discharge.

Any facility of this type should be constructed on right of way or easement. If there is insufficient right of way, alternate locations should be investigated. The local community may develop basins away from the site in conjunction with the highway project, or have a readily available basin close by. In either case project drainage should be directed to these facilities when appropriate.

The maintenance and ownership of these facilities should be discussed with the local community as these facilities will require periodic maintenance. For more information on this topic see DR 900 "Storage" of this manual.

**DR 202-18 WATER RELATED IMPACTS SUMMARY**

When considering environmental issues during the design process, it is recommended to avoid impacts to water resources where possible. When it becomes clear that impacts are unavoidable, the next step is to minimize these impacts. Once these unavoidable impacts have been determined, mitigation may be required in some cases. Where possible, enhancement of water resource may also be considered in a project.

The Water Related Impact Summary (See Exhibit 200-3) was developed to aid the project team in the decision-making process described above. This document is required for all projects.

As described in the exhibit, it is required to fill out Section 1: Impact Checklist for each alternate considered in the conceptual design phase of the project. This will aid in the comparison of water related impacts associated with each alternate. Completion of Section 2: Impact Discussion is only required for the selected alternate and is used to describe the avoidance, minimization, mitigation or enhancement measures that have been considered in the project. As noted in DR 300, the Water Related Impacts Summary is required in the Drainage Folders for the project.



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	<i>Subject</i> National Flood Insurance Program

## DR 203-1    GENERAL

For decades, the national response to flood disasters was limited to building flood control works (dams, levees, seawalls, etc.) and providing disaster relief to flood victims. To compound the problem, the public could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked. In the face of mounting flood losses, Congress created legislation to establish a floodplain management program to reduce annual flood losses through more careful planning and providing property owners with affordable flood insurance. The result of this legislation was the National Flood Insurance Program (NFIP). The NFIP is a very comprehensive program that deals with a plethora of floodplain management topics. This manual only covers portions of the program that affect highway construction and only constitutes a very small portion of the program.

"Floodplain Management" means operating an overall community program of corrective and preventive measures for reducing flood damage, including (but not limited to) emergency preparedness plans and other measures aimed at the present and future use of the floodplain. Floodplain management includes specific local codes and ordinances that provide standards for the location and design of development within flood-prone areas. These measures may be adopted in any manner that is legally enforceable for a particular community. Typically, they take the form of zoning, subdivision or building requirements, and/or a special purpose floodplain ordinance.

A key element of the NFIP was mapping of the nations flood prone areas. Two primary concepts used in identifying these areas were floodplains and floodways. The language adopted by the NFIP has several specific terms that all relate to floodplains and floodways.

Generally speaking, a floodplain is defined as any land area that is susceptible to being inundated by water from any source. The NFIP adopted the 100 year flood as the standard for determination of floodplain limits for purposes of the program. In the NFIP program, the 100 year flood is referred to as the Base Flood and the resulting water surface elevations are referred to as Base Flood Elevations or (BFE). The limits of the 100 year floodplain as shown on the NFIP maps are referred to as Special Flood Hazard Areas (SFHA's).

Another key concept in the program is the floodway. Generally speaking, the

floodway is the part of the floodplain kept clear of obstructions to allow the passage of floodwater. As adopted by the NFIP, the Regulatory Floodway is defined as “A floodplain management tool that is the regulatory area defined as the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood discharge can be conveyed without increasing the BFEs more than a specified amount.”

Not all streams will have floodways established. This depends on the amount of detail that has been invested into the flood study for the stream. In areas that have been subject to detailed FEMA studies, Special Flood Hazard Areas and BFEs or flood depths will be shown on the NFIP Maps. In most cases, areas with detailed studies will also show floodways on the NFIP maps. NFIP maps are discussed in section 203-5.

### **DR 203-2 Flood Insurance**

The National Flood Insurance Act of 1968, as amended, (42 U.S.C. 4001-4127) requires that communities (See DR 203-4) adopt adequate land use and control measures to qualify for insurance. Federal criteria promulgated to implement this provision contain the following requirements which can affect certain highways:

- In riverine situations, when the Administrator of the Federal Insurance Administration has identified the flood prone area, the community must require that until a floodway has been designated, no use, including land fill, be permitted within the floodplain area having special flood hazards for which base flood elevations have been provided; unless it is demonstrated that the cumulative effect of the proposed use, when combined with all other existing and reasonably anticipated uses of a similar nature, will not increase the water surface elevation of the 100-year flood more than one foot at any point within the community.
- After the floodplain area having special flood hazards has been identified and the water surface elevation for the 100-year flood and floodway data have been provided, the community must designate a floodway which will convey the 100-year flood without increasing the water surface elevation of the flood more than the surcharge at any point and prohibit, within the designated floodway, fill, encroachments, and new construction and substantial improvements of existing structures which would result in any increase in flood heights within the community during the occurrence of the 100-year flood discharge.
- The participating cities and/or counties agree to regulate development in the designated floodplain and floodway through regulations adopted in a floodplain ordinance. The ordinance requires that development in the designated floodplain be consistent with the intent, standards and criteria set by the National Flood Insurance Program.

### **DR 203-3 Flood Disaster Protection**

The Flood Disaster Protection Act of 1973 (PI 93-234, 87 Stat. 975) denies Federal financial assistance to flood prone communities that fail to qualify for



flood insurance. Formula grants to states are excluded from the definition of financial assistance, and the definition of construction in the Act does not include highway construction; therefore, Federal aid for highways is not affected by the Act. The Act does require communities to adopt certain land use controls to qualify for flood insurance. These land use requirements could impose restrictions on the construction of highways in floodplains and floodways in communities that have qualified for flood insurance. A floodway, as used here and as used with the National Flood Insurance Program, is that portion of the floodplain required to pass a flood that has a 1-percent chance of occurring in any 1-year period without cumulatively increasing the water surface elevation more than a selected surcharge, usually *one foot*.

#### DR 203-4 Local Community

The local community with land use jurisdiction, whether it is a city, county, or state, has the responsibility for enforcing National Flood Insurance Program (NFIP) regulations in that community, if the community is participating in the NFIP. Consistency with NFIP standards is a requirement for Federal-aid highway actions involving regulatory floodways. The community, by necessity, is the one who must submit proposals to Federal Emergency Management Agency (FEMA) for amendments to NFIP ordinances and maps in that community should that be necessary. The highway agency (KYTC) requesting these amendments shall develop these proposals for the community. The highway agency should then deal directly with the community and, through them, deal with FEMA.

Determination of the status of a community's participation in the NFIP and review of applicable NFIP maps and ordinances are, therefore, essential first steps in conducting location hydraulic studies and preparing environmental documents. To determine if a community is participating in the NFIP, refer to the Community Status Book maintained by FEMA. The community status books for the various states can be found at the following website:

<http://www.fema.gov/fema/csb.shtm>

Every community participating in the NFIP will have a designated Local Floodplain Coordinator. The Local Floodplain Coordinator is the local communities' primary point of contact for NFIP issues (See DR 204-6).

#### DR 203-5 NFIP Maps

Where NFIP maps are available, their use is mandatory in determining whether a highway location alternative will include an encroachment on the base floodplain. Before the Map Modernization Project, three types of NFIP maps were published:

- Flood Hazard Boundary Map (FHBM),
- Flood Boundary and Floodway Map (FBFM), and
- Flood Insurance Rate Map (FIRM).

A FHBM is based on a detailed hydraulic study and, therefore, the floodplain boundaries shown are approximate.

A FBFM is derived from detailed hydraulic studies and should provide reasonably accurate information. A FBFM shows the 100 Year and 500 Year Floodplain boundaries and Floodways. The hydraulic data from which the FBFM was derived are available from FEMA's contractor. This is normally in the form of a computer input data records for calculating water surface profiles.

The FIRM is generally produced at the same time as the FBFM, using the same hydraulic model. A FIRM shows the insurance rate zone and base flood elevations where detailed studies were conducted. The FIRM for the more recent mappings also shows the Floodway boundaries.

Communities may or may not have published one or more of the above maps depending on their level of participation in the NFIP. Information on community participation in the NFIP is provided in the "National Flood Insurance Program Community Status Book" which is published semiannually for each State.

In 1997 FEMA developed the Map Modernization Program to modernize the flood insurance mapping for the entire country. Communities that have had their maps updated through this project will have all necessary information contained in their FIRMs. The new maps do not have separate FHBMs or FBFMs. A distinctive feature of the new FIRM is that the mapping is based on aerial photography and GIS technology.

#### **DR 203-6 Executive Order 11988**

Presidential Executive Orders (E.O.) have the effect of law in the administration of programs by Federal agencies. These laws apply directly to federal agencies. While executive orders do not directly apply to State Highway Department, any highway project using federal money has to follow these Executive Orders.

Executive Order 11988, May 24, 1977, (Federal Register, April 26, 1979 (44 CFR 24678, and 23 CFR 650, Subpart A) requires each Federal agency, in carrying out its activities, to take the following actions:

- Reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains; and
- Evaluate the potential effect of any actions it may take in a floodplain, to assure its planning programs reflect consideration of flood hazards and floodplain management.

#### **DR 203-7 FHWA - FEMA Memorandum Of Understanding**

Although Executive Order 11988 was not a part of the original NFIP regulations, it served to push the NFIP regulations down to state Departments of Transportation via the Federal Highway Administration. On June 25, 1982, the Federal Highway Administration distributed a memo entitled "Procedures for Coordination Highway Encroachment on Floodplains with the Federal Emergency Management Agency (FEMA)". This memorandum set the

groundwork for the procedures used by most DOTs in dealing with floodplain management. Much of language in the following chapter (DR 204) is derived from the procedures outlined in this memorandum.

**DR 203-8 Kentucky Laws**

Floodplain Management for properties owned by the Commonwealth of Kentucky is regulated by the Kentucky Administrative Regulations, specifically 200 KAR 6:040. Kentucky Administrative Regulations can be found on the Kentucky Legislature home page at <http://www.lrc.ky.gov/Law.htm>

This regulation along with the previously mentioned memorandums, federal regulations and executive orders serve as the basis for KYTC policy.



<b>Drainage</b>	<i>Chapter</i>  STORMWATER & FLOODPLAIN MANAGEMENT
	<i>Subject</i>  KYTC Floodplain Management Policy

**DR 204-1      GENERAL**

KYTC’s policies on floodplain management are shaped by several Federal and State laws. These laws and the resulting KYTC policy are intended to ensure actions involving floodplains are consistent with NFIP standards.

The types of analyses and coordination that are necessary with KYTC projects depend on the type of encroachment, if any, that the project causes into a floodplain or regulatory floodway.

It should be noted that this chapter only speaks to design criteria as it applies to the NFIP, which is primarily concerned with limiting damage to surrounding properties. Drainage structures should be analyzed using design storm criteria as well. Design storm criteria are discussed in Chapter DR 400.

**DR 204-2      ENCROACHMENT CONCEPT**

Encroachments are defined as any construction, placement of fill or similar alteration of topography in a floodplain or floodway that reduces the area available to convey floodwaters. Most highway drainage structures that cross a stream will require some encroachment into a floodplain. Floodplains are generally very wide, and avoiding them entirely is often not economical.

Encroachments into floodways are treated differently than encroachments into floodplains. Encroachments into floodways should be avoided; however, there are cases when an encroachment into floodway may be acceptable.

**DR 204-3      ENVIRONMENTAL PROCESS**

Most KYTC projects are subject to a rigorous environmental process to assess and mitigate environmental impacts. A part of this process involves an evaluation of the impacts to floodplains and floodways. The environmental process produces several different documents that may identify impacts to floodplains and floodways as well as many other environmental concerns. For more information on these documents see Chapter HD 400 in the Highway Design Manual.

The draft Environmental Impact Statement or Environmental Assessment (EIS/EA) should indicate the NFIP status of affected communities, the

encroachments anticipated and the need for floodway or floodplain ordinance amendments.

If a determination by FEMA would influence the selection of an alternative, a commitment from FEMA should be obtained prior to the final environmental impact statement (FEIS) or a finding of no significant impact (FONSI). Otherwise this later coordination may be postponed until the design phase.

For projects that will be processed with a categorical exclusion, coordination may be carried out during design. However, the outcome of the coordination at this time could change the class of environmental processing.

#### **DR 204-4 APPLICABILITY**

As a general rule, floodplain encroachment criteria apply to streams with drainage areas that are larger than one square mile. However, some floodplains and floodways for streams with smaller drainage areas are shown on the NFIP maps. If stream impact occurs on a mapped floodplain or floodway, the criteria in this chapter will apply regardless of drainage area.

#### **DR 204-5 Risk Assessment**

The Risk Assessment is used to evaluate the impacts of proposed bridge projects. The Risk Assessment is described in more detail in DR 807. The risk form is shown in Exhibit 800-1.

If a proposed bridge structure meets Level 1 criteria (the answer to all of the questions in the Level 1 section of the Risk Assessment form are No), the structure is considered a low risk. In this case, KYTC does a Level 1 analysis, which simply means replacing the structure with an equivalent one.

When any of the Level 1 criteria is exceeded, the risks are considered higher and a Level 2 analysis is required. Level 2 analysis is more detailed analysis that generally involves water surface profile calculations and scour analysis.

Level 3 analysis is necessary only for high risk locations, extraordinarily complex problems, and after the fact analyses where losses and liability costs are high.

#### **DR 204-6 Local Floodplain Coordinators**

Participating communities in the National Flood Insurance will have a designated local Floodplain Coordinator. It is essential that the project team contact these Local Floodplain Coordinators and involve them in the early phases of the project development process. A listing of the Local Floodplain Coordinators can be found on the drainage website at <http://transportation.ky.gov/design/drainage/drainage.html>

#### **DR 204-7 Coordination Required For All Encroachments**

Any encroachment into a floodplain or floodway that meets the applicability

requirements of Section 204-4, requires coordination with Local Floodplain Coordinators and the Division of Water.

The Drainage Branch will send notification letters to the Division of Water (DOW) and/or Local Floodplain Coordinators outlining the projects impacts for these encroachments. These letters will be sent immediately following the development of hydraulic models for the project. These letters will contain the following information at a minimum:

- Location and description of the proposed hydraulic structures
- Information on the affected area such as: community name, effective date of study, community number, panel number and location of impact relative to any sections shown on the FIRMs
- Brief description of the specific impacts of each of these structures.

#### **DR 204-8 Allowable Increase (Rise)**

The extent of an encroachment into a floodplain is quantified by the amount of increase in water surface elevations caused by the encroachment for the 100 year storm (1%). As mentioned earlier, FEMA refers to this storm as the Base Flood and the resulting water surface elevations as the Base Flood Elevations (BFE). Limits to the amount of increase that is allowable in the BFEs are promulgated in the NFIP standards and in some cases in a city ordinance.

If the project does not involve an Interstate, the project team may base this allowable increase on thresholds called for in a city ordinance. For purposes of this manual, allowable increases based on city ordinances will be referred to as "local allowable increases." When there is no such city ordinance or the project is located on an Interstate system, the allowable increase will be one foot.

This increase is based on a cumulative effect. Therefore if an existing structure (or other encroachment in the project vicinity) has already caused increases in the BFEs, a new structure will only be allowed to increase the BFEs by an amount equal to the allowable rise less the rise created by the existing structure.

Although it is not generally recommended, the allowable rise criteria may be increased if it is determined that it is not feasible to meet the requirements listed above. If this option is chosen, it must be demonstrated that it is the only feasible alternative for the project. In areas where there is a mapped floodplain, this option requires the implementation of the Map Revision process discussed in DR 204-13.

#### **DR 204-9 Encroachments Into Floodplains Without Detailed Studies**

The analysis and coordination involved with encroachments into floodplains is dependent on the level of study to which a stream has been subjected. To determine if an area has been subject to a detail study, BFEs will be shown on the NFIP maps. If BFE is shown, the stream has been subject to a detail study.

Highway Encroachment On A FEMA Mapped Floodplain Without A Detailed Study

Where detailed studies have not been performed, and a floodplain is shown on the FEMA maps, the stream has been studied with approximate techniques. Streams that have been subject to approximate studies will show the floodplain as Zone A. In communities where no detailed flood insurance studies have been performed, the Base Flood Elevations will have to be determined by hydraulic modeling. Once the Base Flood Elevations have been established, the crossing (or any other impact) should be designed to keep increases to the Base Flood Elevations less than the allowable increase as discussed in DR 204-8.

Highway Encroachment On An Unidentified Floodplain

Since 101 of the 120 counties in Kentucky have some FEMA mapping, all communities will be considered FEMA mapped. Notwithstanding the exceptions noted in the paragraph below, any encroachment into floodplains in this category should follow the criteria described above under "Highway Encroachment On A FEMA Mapped Floodplain Without A Detailed Study".

On unidentified floodplains, the project team may elect to increase the allowable rise criteria. As mentioned earlier, it must be demonstrated that increasing this allowable rise is the only feasible alternative for the project. When this option is chosen, flooding easements must be purchased that include the limits of the proposed 100 year floodplain.

**DR 204-10 Encroachments Into Floodplains With Detailed Studies**

Highway Encroachment on a FEMA Mapped Floodplain With a Detailed Study, and a Floodway Shown with No Encroachment Into the Floodway

In most detailed study areas, floodways will be shown inside the limits of the floodplain. In these situations design the highway crossing (or any other impact) in a manner such that their components are excluded from the floodway. This is the simplest way to be consistent with the standards and should be the initial alternative evaluated when floodways are shown. Once it is proven that the project does not encroach on the floodway, no further analysis is necessary. To make a determination of whether or not the project encroaches on a floodway, it is usually necessary to obtain the hydraulic models upon which the FEMA mapping is based.

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Highway Encroachment On A FEMA Mapped Floodplain With A Detailed Study, but Without a Floodway Shown

In rare instances a floodplain may be mapped via a detailed study but no floodway delineated. In communities where a detailed flood insurance study has been performed but no regulatory floodway designated, the highway crossing (or any other impact) should be designed to keep increases to the Base Flood Elevations less than the allowable increase as discussed in DR 204-8. This analysis shall be based on technical data from the flood insurance study.

**DR 204-11 No Rise (No Impact) Floodway Encroachment**

If a project element encroaches on the Floodway as shown on the NFIP map but has no effect on the Floodway water surface elevation (such as piers in the Floodway), the project may normally be considered as being consistent with the standards. This is justified if hydraulic conditions can be improved so that no water surface elevation increase or change in lateral limits of the floodway or floodplain is reflected in the computer printout for the new conditions. This is what is commonly referred to as a “No Rise” or “No Impact” certification.

If a floodway is encroached upon, this may trigger a rigorous review process by which specific modeling guidelines must be followed to ensure that a floodway encroachment is not causing any change to the horizontal and vertical limits of the floodplain and floodway. A FEMA review may be required. The specific modeling procedures for No Rise certification and a certification form are shown in Exhibit 200-2. The No Rise certification will be completed by the designer and submitted with the hydraulic models to the Local Floodplain Coordinator and the Central Office Drainage Engineer. This process should take place immediately after the dimensions and layout of the hydraulic structure are determined.

**DR 204-12 Coordination With FEMA**

The encroachments described in DR 204-8 through DR 204-10 do not generally require coordination with FEMA. However, it is intended that there should be coordination with FEMA, through the Local Floodplain Coordinator, in situations where administrative determinations are needed involving a regulatory Floodway or where flood risks in NFIP communities are significantly impacted. The circumstances which would ordinarily require coordination with FEMA include the following:

1. A proposed crossing encroaches on a regulatory floodway and the No Rise criteria described in DR 204-8 cannot be met. This would require an amendment to the floodway map and a map revision as described in DR-204-13.
2. A proposed crossing encroaches on a floodplain shown on an NFIP Map and the maximum one-foot increase in the base flood elevation would be exceeded. This will require a map revision as described in DR-204-13.
3. A local community is expected to enter into the regular program within a reasonable period, and detailed floodplain studies are under way.



4. A local community is participating in the emergency program, and base FEMA flood elevation in the vicinity of insurable buildings is increased by more than one foot. Where insurable buildings are not affected, it is sufficient to notify FEMA of changes to base flood elevations as a result of highway construction.

At a minimum, coordination means furnishing to FEMA the draft EIS/EA and, upon selection of an alternative, furnishing to FEMA, through the Local Floodplain Coordinator, a preliminary site plan, water surface elevation information, and technical data in support of a map revision request as required. The designer will prepare this information and forward it to the Central Office Drainage Engineer. The Central Office Drainage Engineer will then forward the information to the Local Floodplain Coordinator and FEMA.

#### **DR 204-13    MAP REVISIONS**

Some encroachments into floodplains or regulatory floodways will require a map revision. It cannot be stressed enough that map revisions should be avoided. When a map revision is required, it is imperative that the process be initiated in the early project phases. As soon as the dimensions and layout of the hydraulic structure involved are determined, the map revision process should be initiated.

Map revisions should be coordinated with the Central Office Drainage Engineer and the Local Floodplain Coordinator.

Details of the requirements for map revisions can be found in the FEMA document "Guidelines and Specifications for Flood Hazard Mapping Partners." Volume 2 of this document details the processes for Map Revisions.

#### **CONDITIONAL LETTERS OF MAP REVISION (CLOMR) & LETTERS OF MAP REVISION (LOMR)**

Revisions to NFIP maps that are not substantial are accomplished by dissemination of a letter describing the changes. Although there are many different types of these letters, KYTC projects that require a map revision will likely involve the Conditional Letter of Map Revision (CLOMR) and the Letter of Map Revision (LOMR).

If the project team decides that a map revision is appropriate for the project, the projects designer will initiate the CLOMR process. This process is essentially a request made to FEMA to modify the floodplain or regulatory floodway based on the proposed construction.

Once the project is complete, the Central Office Drainage Engineer will request a letter from the Division of Construction certifying the project was constructed according to the plans. This information will be sent to the designer for initiation of the LOMR process. This essentially validates the conditions stated in the original COLOMR and finalizes the results in an official map change.

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### PHYSICAL MAP REVISIONS

When proposed changes to an NFIP map are determined by FEMA to be substantial, a Physical Map Revision will be required. Physical Map revisions require a higher level of review by FEMA, and have considerable costs associated with them. For more information see the aforementioned "Guidelines and Specifications for Flood Hazard Mapping Partners" published by FEMA.

#### DR 204-14 Revisions Of Floodways That Are Consistent With NFIP Standards

Where it is not cost-effective to design a highway crossing to avoid encroachment on an established Floodway, and No Rise (No Impact) criteria cannot be satisfied, an alternative would be a modification of the Floodway itself. Often, the community will be willing to accept an alternative Floodway configuration to accommodate a proposed crossing provided NFIP limitations on increases in the base flood elevation are not exceeded. This approach is useful where the highway crossing does not cause more than a *one foot* rise in the base flood elevation. In some cases, it may be possible to enlarge the Floodway or otherwise increase conveyance in the Floodway above and below the crossing to allow greater encroachment. Such planning is best accomplished when the Floodway is first established. However, where the community is willing to amend an established Floodway to support this option, the Floodway may be revised.

The responsibility for demonstrating that an alternative Floodway configuration meets NFIP requirements rests with the community. However, this responsibility will be borne by the agency proposing to construct the highway crossing. Floodway revisions must be based on the hydraulic model which was used to develop the current effective Floodway but updated to reflect existing encroachment conditions. This will allow determination of the increase in the base flood elevation that has been caused by encroachments since the original Floodway was established. Alternate Floodway configurations may then be analyzed.

Base flood elevations increases are referenced to the profile obtained for existing conditions when the Floodway was first established.

The Map Revision process described in DR 204-13 is required for these floodway revisions.

#### DR 204-15 Revisions Of Floodway That Are Not Consistent With NFIP Standards

When it would be demonstrably inappropriate to design a highway crossing to avoid encroachment on the floodway and where the floodway cannot be modified such that the structure could be excluded, FEMA will approve an alternate floodway with backwater in excess of the *one foot* maximum only when the following conditions have been met:

- A location hydraulic study has been performed according to FHWA, "Location and Hydraulic Design of Encroachments on Floodplains" (23 CFR 650, Subpart A) and FHWA finds the encroachment is the only practical alternative.

- The constructing agency has made appropriate arrangements with affected property owners and the community to obtain flooding easements or otherwise compensate them for future flood losses due to the effects of backwater greater than one foot.
- The constructing agency has made appropriate arrangements to assure that the National Flood Insurance Program and Flood Insurance Fund will not incur any liability for additional future flood losses to existing structures that are insured under the Program and grandfathered in under the risk status existing before the construction of the structure.
- Before initiating construction, the constructing agency provides FEMA with revised flood profiles, Floodway and floodplain mapping, and background technical data necessary for FEMA to issue revised Flood Insurance Rate Maps and Flood Boundary and Floodway Maps for the affected area, upon completion of the structure.

**DR 204-16 KYTC Floodplain Management Flowcharts**

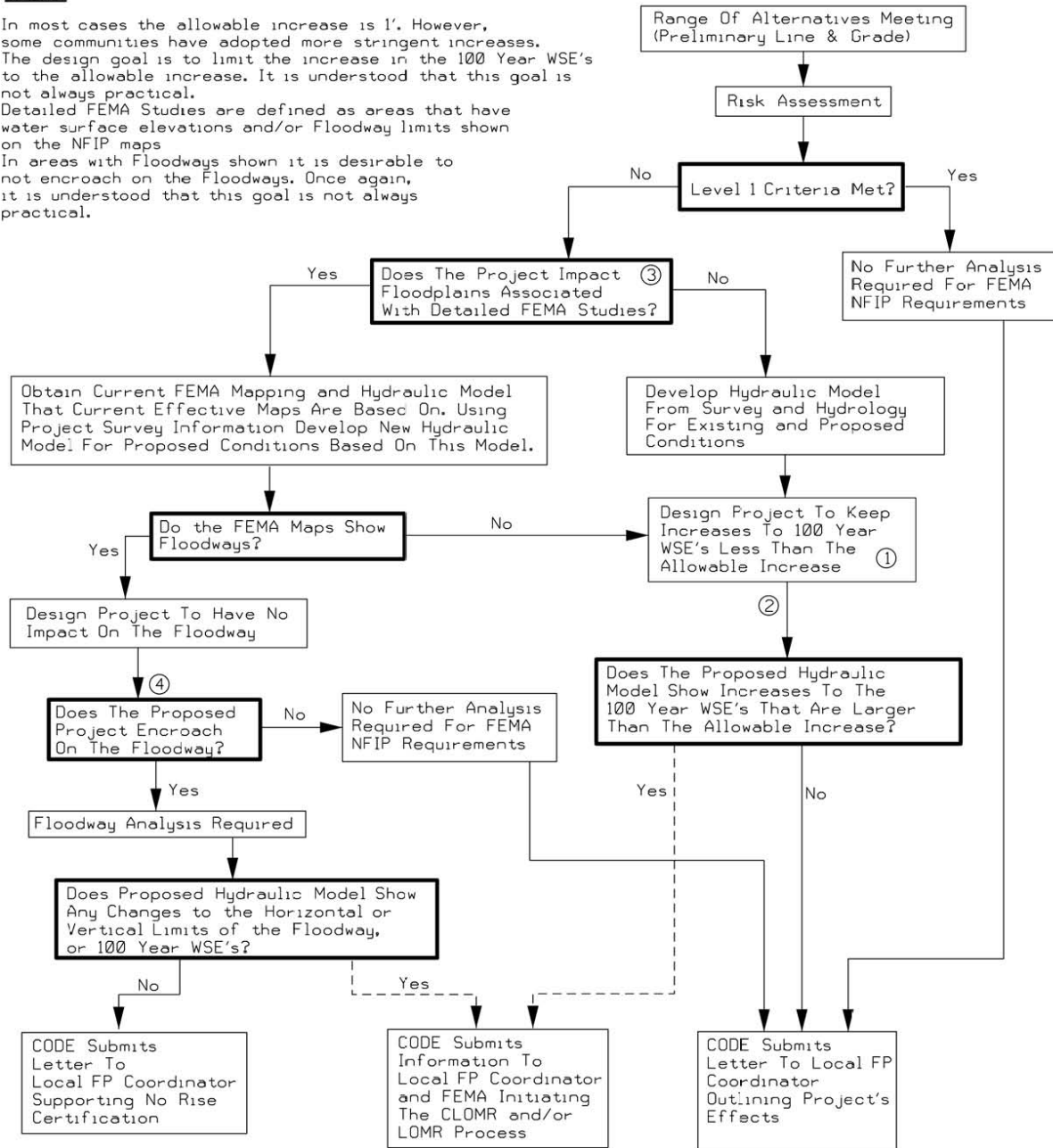
Exhibit 200-1 "Floodplain Policy Flowcharts" summarizes KYTC floodplain management policy in two flow charts. The applicable flowchart depends on whether the area of the project has been mapped on a NFIP map.



**FLOODPLAIN POLICY FLOWCHART FOR IMPACTS TO FEMA-MAPPED FLOODPLAINS/FLOODWAYS**

**NOTES**

1. In most cases the allowable increase is 1'. However, some communities have adopted more stringent increases.
2. The design goal is to limit the increase in the 100 Year WSE's to the allowable increase. It is understood that this goal is not always practical.
3. Detailed FEMA Studies are defined as areas that have water surface elevations and/or Floodway limits shown on the NFIP maps
4. In areas with Floodways shown it is desirable to not encroach on the Floodways. Once again, it is understood that this goal is not always practical.



Abbreviations  
 CODE - Central Office Drainage Engineer  
 NFIP- National Flood Insurance Program  
 FP - Floodplain  
 DOW - Division of Water  
 FEMA - Federal Emergency Management Agency  
 WSE - Water Surface Elevation

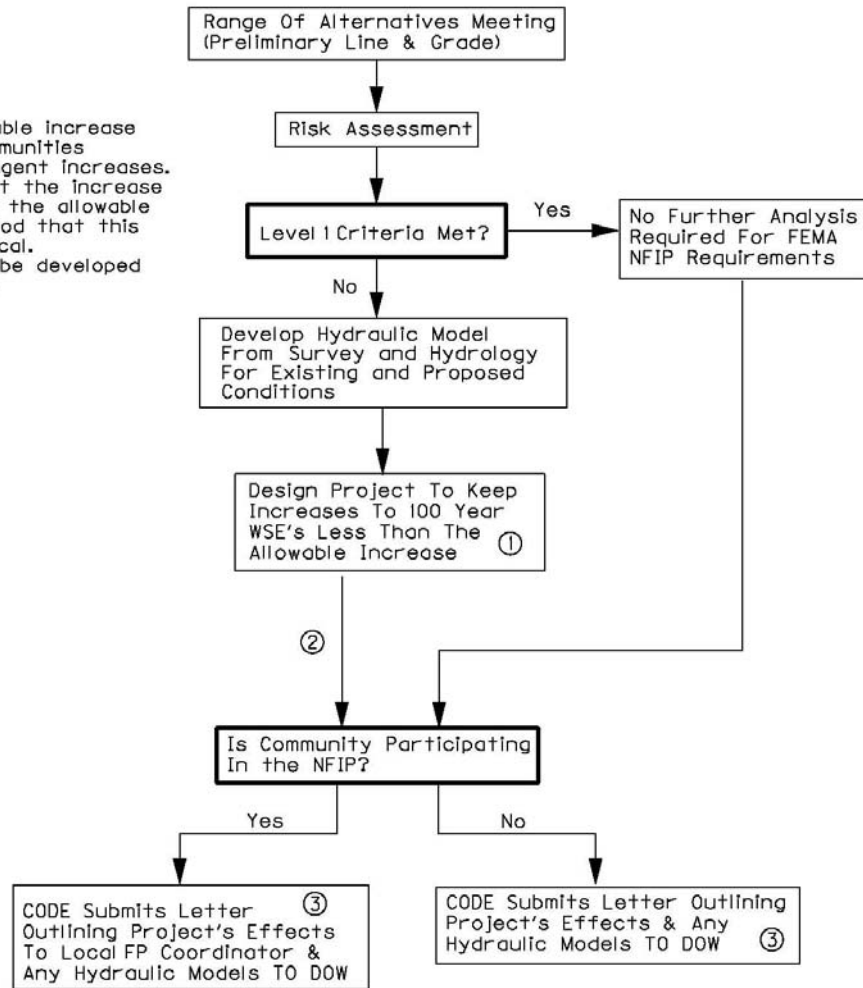
----- Indicates Undesirable Path

Circled Numbers  
 Correspond to Notes

**FLOODPLAIN POLICY FLOWCHART FOR IMPACTS TO UNMAPPED FLOODPLAINS**

**NOTES**

1. In most cases the allowable increase is 1'. However, some communities have adopted more stringent increases.
2. The design goal is to limit the increase in the 100 Year WSE's to the allowable increase. It is understood that this goal is not always practical.
3. Hydraulic models will not be developed if Level 1 criteria is met.



Abbreviations  
 CODE - Central Office Drainage Engineer  
 NFIP- National Flood Insurance Program  
 FP - Floodplain  
 DOW - Division of Water  
 FEMA - Federal Emergency Management Agency  
 WSE - Water Surface Elevation

Circled Numbers  
 Correspond to Notes



## Federal Emergency Management Agency

DHS-EP&R (FEMA-FIMA) Region IV  
3003 Chamblee-Tucker Road  
Atlanta, Georgia 30341

R4-MT

January/04

### **PROCEDURES FOR “NO-RISE” CERTIFICATION FOR PROPOSED DEVELOPMENTS IN REGULATORY FLOODWAYS**

Section 60.3 (d) (3) of the National Flood Insurance Program (NFIP) regulations states that a community shall *“prohibit encroachments, including fill, new construction, substantial improvements, and other developments within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base (100-year) flood discharge.”*

Prior to issuing any building grading or development permits involving activities in a regulatory floodway, the community must obtain a certification stating the proposed development will not impact the pre-project base flood elevations, floodway elevations, or floodway data widths. The certification should be obtained from the permittee and signed and sealed by a professional engineer.

The engineering or “no-rise” certification must be supported by technical data. The supporting technical data should be based upon the standard step-backwater computer model utilized to develop the 100-year floodway shown on the community’s effective Flood Insurance Rate Map (FIRM) or Flood Boundary and Floodway Map (FBFM) and the results tabulated in the community’s Flood Insurance Study (FIS).

Although communities are required to review and approve the “no-rise” submittals, they may request technical assistance and review from the FEMA regional office. However, if this alternative is chosen, the community must review the technical submittal package and verify that all supporting data, listed in the following paragraphs, are included in the package before forwarding to FEMA.

To support a “no-rise” certification for proposed developments encroaching into the regulatory floodway, a community will require that the following procedures be followed:

#### **Currently Effective Model**

1. Furnish a written request for the step-backwater computer model for the specified stream and community, identifying the limits of the requested data. A fee will be assessed for providing the data. Send data requests to:

Federal Emergency Management Agency  
Region IV HIRA Branch  
3003 Chamblee-Tucker Road  
Atlanta, GA 30341

Or send to:

FIS Information Specialist  
Dewberry & Davis  
8401 Arlington Boulevard  
Fairfax, VA 22031-4666

#### **Duplicate Effective Model**

2. Upon receipt of the step-backwater computer model, the engineer should run the original step-backwater model to duplicate the data in the effective FIS.

#### **Existing Conditions Model**

3. Revise the original step-backwater model to reflect site specific existing conditions by adding new cross-sections (two or more) in the vicinity of the proposed development, without the proposed development in place. Floodway limits should be manually set at the new cross-section locations by measuring from the effective FIRM or FBFM. The cumulative reach lengths of the stream should also remain unchanged. The results of these analyses will indicate the 100-year floodway elevations for revised existing conditions at the proposed project site.

#### **Proposed Conditions Model**

4. Modify the revised existing conditions model to reflect the proposed development at the new cross-sections, while retaining the currently adopted floodway widths. The over-bank roughness coefficients should remain the same unless a reasonable explanation of how the proposed development will impact Manning's "n" values should be included with the supporting data. The results of this floodway run will indicate the 100-year floodway elevations for proposed conditions at the project site. These results must indicate NO impact on the 100-year flood elevations, floodway elevations, or floodway widths shown in the Duplicate Effective Model or in the Existing Conditions Model.

The original FIS model, the duplicate effective FIS model, the revised existing conditions model, and the proposed conditions model should all produce the same exact results.

The "no-rise" supporting data and a copy of the engineering certification must be submitted to and reviewed by the appropriate community official prior to issuing a permit.

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The “no-rise” supporting data should include, but may not be limited to:

- a. Duplicate of the original FIS step-backwater model printout or floppy disk.
- b. Revised existing conditions step-backwater model.
- c. Proposed conditions step-backwater model.
- d. FIRM and topographic map, showing floodplain and floodway, the additional cross-sections, the site location with the proposed topographic modification superimposed onto the maps, and a photocopy of the effective FIRM or FBFM showing the current regulatory floodway.
- e. Documentation clearly stating analysis procedures. All modification made to the original FIS model to represent revised existing conditions, as well as those made to the revised existing conditions model to represent proposed conditions, should be well documented and submitted with all supporting data.
- f. Copy of effective Floodway Data Table copied from the FIS report.
- g. Statement defining source of additional cross-section topographic data and supporting information.
- h. Cross-section plots, of the added cross sections, for revised existing and proposed conditions.
- i. Certified planimetric (boundary survey) information indicating the location of structures on the property.
- j. Copy of the microfiche, or other applicable source, from which input for original FIS HEC-2 model was taken.
- k. Floppy disk with all input files.
- l. Printout of output files from EDIT runs for all three floodway models.

The engineering “no-rise” certification and supporting technical data must stipulate NO IMPACT on the 100-year flood elevation, floodway elevations, or floodway widths at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance (usually 1-mile, depending on hydraulic slope of the stream) upstream and downstream of the development site to ensure proper “no-rise” certification.

Attached is a sample “no-rise” certification form that can be completed by a registered professional engineer and supplied to the community along with the supporting technical data when applying for a development permit.



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**ENGINEERING “NO-RISE” CERTIFICATION**

This is to certify that I am a duly qualified engineer licensed to practice in the state of  
Kentucky. It is to further certify that the attached technical data supports the fact that proposed  
\_\_\_\_\_ will not impact  
*(Name of Development)*

the Base Flood Elevations (100-year flood), floodway elevations and the floodway widths on  
\_\_\_\_\_ at published sections in the  
*(Name of Stream)*

Flood Insurance Study for \_\_\_\_\_, dated \_\_\_\_\_  
*(Name of Community & Community ID Number)*

\_\_\_\_\_ and will not impact the Base Flood Elevations (100-  
year flood), floodway elevations, and floodway widths at unpublished cross-sections in the  
vicinity of the proposed development.

**Signature** \_\_\_\_\_

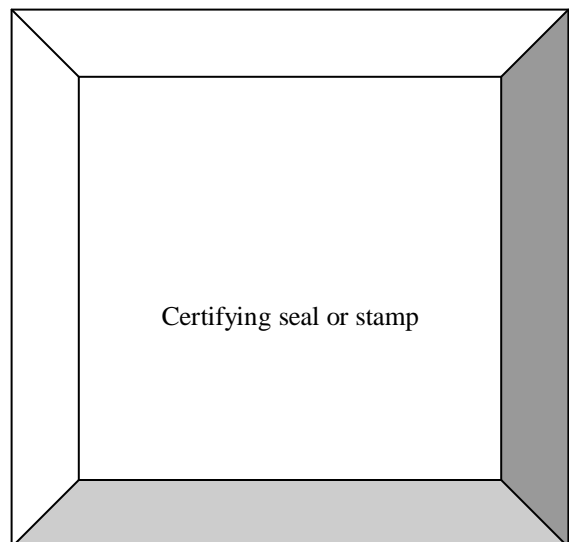
**Phone Number** \_\_\_\_\_ **EMAIL** \_\_\_\_\_

**Representing** \_\_\_\_\_

**Address** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip Code** \_\_\_\_\_

\_\_\_\_\_  
*(Date)*



Form  
Revised 4/01

### WATER RELATED IMPACTS SUMMARY

<b>County</b>	Harrison	<b>Route No.</b>	US 27	<b>Item No.</b>	6-1053.00
<b>Date</b>	11-08-07	<b>Program #</b>	7370501D		
<b>Federal Project No.</b>	BRO 0272(101)				
<b>State Project No.</b>	FD52 049 0027 006-007				
<b>Alternate</b>	Alternate #2A				
<b>Location Engineer</b>	Brad Eldridge				

#### **Section 1: Impact Checklist**

Complete this section for each alternative considered at the conclusion of Phase 1 design.

FLOODPLAIN IMPACTS		
FEMA Study Type	Yes	Community No.
Detailed FEMA Study with delineated floodway*		
Detailed FEMA Study without delineated floodway*		
Approximate FEMA Study		
No FEMA Study		
<p>* May require initiation of the map revision process if impacts to water surface elevations cannot be avoided. Potential impacts to floodplains and/or floodways shall be assessed early in the project. Refer to Sections DR 203 and DR 204 of the Drainage Manual.</p>		

SIGNIFICANT RESOURCE IMPACTS				
Are open sinkholes impacted? If so, how many sinkholes are impacted?	Yes		No	
Are wetlands impacted? If so, how many total acres are estimated? _____ acres	Yes		No	
Are any of the streams in the project area designated "Special Use Waters" (e.g. Wild Rivers, Exceptional Waters, Outstanding State Resource Water, etc.)?	Yes		No	
<p>Where possible, alignments should be developed that avoid significant resources. When it becomes impossible to avoid a significant resource, the project should be designed to minimize these impacts. Significant resource impacts are discussed in DR 202 of the drainage manual. Wetland impacts and their costs are also discussed in DR 500 of the Drainage Manual.</p> <p>Projects that impact special use waters may require an individual KPDES Erosion Control Permit. Contact the Division of Environment analysis for more information.</p>				

<b>STREAM CHANNEL IMPACTS</b>				
Will stream relocations (channel changes) be needed? If so, how many total linear feet are estimated? _____ LF	Yes		No	
Will new culverts or culvert extensions be constructed? If so, how many total linear feet are estimated? _____ LF	Yes		No	
Will temporary stream crossings be needed?	Yes		No	
Will excess material sites that require permitting be needed?	Yes		No	
Will bridges be constructed?	Yes		No	
<p>On highway projects that involve stream crossings such as bridge and culverts, it is often not feasible to totally avoid stream channel impacts. In these cases, design the project to minimize the impacts. Stream relocations should be avoided if possible. If stream relocations are unavoidable design the project to minimize their impacts. Stream channel impacts are discussed in DR 506, 601-3, 608-2, and 802-3 of the drainage manual.</p>				

**Section 2 : Impact Discussion**

Complete this section for the chosen alternate. Discuss the selected alternate’s influence on each of the impacts listed above. Discuss any avoidance, minimization and/or mitigation measures included in the project.