

TDOT DESIGN DIVISION

DRAINAGE MANUAL

**CHAPTER II
GENERAL DRAINAGE
POLICIES & PRACTICES**

CHAPTER 2 – GENERAL DRAINAGE POLICIES AND PRACTICES

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SECTION 2.01 – INTRODUCTION

2.01.1 PURPOSE

Drainage concerns are one of the most important aspects of roadway design and construction. The purpose of this chapter is to outline policies that guide and influence the practice of drainage design for the Tennessee Department of Transportation. A portion of this chapter will describe legal issues that influence policies and design criteria.

2.01.2 POLICY VS. CRITERIA

Policy and criteria statements are closely related - criteria being the TDOT's numerical or specific guidance which is founded in broad policy statements. For this Manual, the following definitions of policy and criteria apply:

Policy - is a definite course of action or method of action, selected to guide and determine present and future decisions.

Design Criteria - are the standards by which a policy is carried out or placed in action. Thus design criteria are needed for design; policy statements are not.

The following is an example of a policy statement:

"The designer will size the drainage structure to accommodate a flood compatible with the projected traffic volumes."

The design criteria for designing the structure might be:

"For a roadway designated as a collector, drainage structures shall be designed for a 10-year flood (exceedance probability of 10%). For a roadway designated as a freeway, a drainage structure shall be designed for a 50-year flood (exceedance probability of 2%)."

SECTION 2.02 – GENERAL LEGAL ISSUES

2.02.1 INTRODUCTION

Various drainage laws and rules are applicable to highway facilities. This portion of the chapter provides information and guidance on the designer's role in the legal aspects of roadway design. After presenting the applicable legal aspects for highway drainage design, federal, state, and local policies will be discussed. This information should not in any way be treated as a manual upon which to base legal advice or make legal decisions. It is also not a summary of all existing drainage laws, and most emphatically, this chapter is not intended as a substitute for legal counsel.

Several generalizations can be made regarding liability. 1) A goal in roadway drainage design should be to perpetuate natural drainage patterns, insofar as practical. 2) The courts look with disfavor upon infliction of injury or damage that could reasonably have been avoided by a prudent designer, even where some alteration in flow is legally permissible. 3) The laws relating to the liability of government entities are undergoing radical change, with a trend toward increased government liability.

The descending order to law supremacy is Federal, State, and then Local, except as provided for in the statutes of the constitution of the higher level of government. The superior level is not bound by laws, rules, or regulations of a lower level of government.

2.02.2 LEGAL ASPECTS

2.02.2.1 FEDERAL LAWS

Federal law consists of the Constitution of the United States, Acts of Congress, and regulations which government agencies issue to implement these acts, Executive Orders issued by the President, and case law. Acts of Congress are published immediately upon issuance and are accumulated for each session of Congress and published in the United States Statutes at Large. Compilations of Federal Statutory Law, revised annually, are available in the United States Code (USC) and the United States Code Service (USCS).

The *Federal Register*, which is published daily, provides a uniform system for making regulations and legal notices available to the public. Presidential Proclamations and Executive Orders, Federal agency regulations and documents having general applicability and legal effect, documents required to be published by an act of Congress and other Federal agency documents of public interest are published in the *Federal Register*. Compilations of Federal regulatory material revised annually are available in the Code of Federal Regulations (CFR).

2.02.2.1.1 DRAINAGE

Federal law does not deal with drainage per se, but many laws have implications which affect drainage design. These include laws concerning:

- Flood insurance and construction in flood hazard areas
- Navigation and construction in navigable waters
- Water pollution control

- Environmental protection
- Protection of fish and wildlife

2.02.2.1.2 SIGNIFICANT LAWS

Some of the more significant Federal laws affecting highway drainage are listed below with a brief description of their subject area.

1. Department of Transportation Act (80 Stat. 941, 49 U.S.C. 1651 et seq.). This act established the United States Department of Transportation and set forth its powers, duties and responsibilities to establish, coordinate, and maintain an effective administration of the transportation programs of the Federal Government.
2. Federal-Aid Highway Acts (23 U.S.C. 101 et seq.). The Federal-Aid Highway Acts provide for the administration of the Federal-Aid Highway Program. Proposed federal-aid projects must be adequate to meet the existing and probable future traffic needs and conditions in a manner conducive to safety, durability and economy of maintenance, and must be designed and constructed according to standards best suited to accomplish these objectives and to conform to the needs of each locality.
3. Federal-Aid Highway Act of 1970 (84 Sta. 1717, 23, U.S.C. 109 (h)). This act provided for the establishment of general guidelines to insure that possible adverse economic, social and environmental effects relating to any proposed Federal-aid project have been fully considered in developing the project. In compliance with the Act, the Federal Highway Administration issued process guidelines for the development of environmental action plans. These guidelines are contained in the Federal-Aid Highway Program Manual Volume 7, Chapter 7, Section 1 (FHPM 7-7-1), and in 23 CFR 795 et seq.
4. Federal-Aid Highway Act of 1966 (80 Stat. 766), amended by the Act of 1970 (84 Stat. 1713), 23 U.S.C. 109 (g). This act required the issuance of guidelines for minimizing possible soil erosion from highway construction. In compliance with these requirements, the Federal Highway Administration issued guidelines which are applicable to all Federal-aid highway projects. These guidelines are included in FHPM 6-7-1-1, 6-7-3-1, 6-7-3-2. Regulatory material is found in 23 CFR 650.201.
5. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provided authorization for highways, highway safety and mass transportation for six years. The act intended to develop a National Highway System that is economically efficient and environmentally sound. It created a foundation for the Nation to compete in the global economy and move people and goods in an energy efficient manner. Under the Act, state and local governments have been given more flexibility in determining transportation solutions, whether transit or highways, and the tools on enhanced planning and management systems to guide them in making the best choices. Funding for the new technologies as well as activities for enhancing environment and safety was also available.
6. The Transportation Equity Act for the 21st Century of June 9, 1998 authorized the Federal surface transportation programs for highways, highway safety, and transit for the 6-year period 1998-2003. The TEA-21 Restoration Act, enacted July 22, 1998,

provided technical corrections to the original law. TEA-21 is considered the combined effect of these two laws.

2.02.2.2 NAVIGABLE WATERS REGULATIONS

The Congress of the United States of America is granted Constitutional power to regulate Interstate commerce. This power includes navigable waters and is essentially carried out by four Federal agencies.

1. Coast Guard. The United States Coast Guard (USCG) has regulatory authority under Section 9 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401 to approve plans and issue permits for bridges and causeways across navigable rivers. The FHWA has the responsibility to determine whether a USCG permit is required. The USCG has two responsibilities:
 - To determine whether or not a USCG permit is required for the improvement or construction of a bridge over navigable waters except for the exemption exercised by the FHWA.
 - To approve the bridge location, alignment, and appropriate navigational clearances in all bridge permit applications.
2. Corps of Engineers. The United States Army Corps of Engineers (USACE, COE, or Corps) has regulatory authority over the construction of dams, dikes, or other obstructions which are not considered bridges or causeways under Section 9 (33 U.S.C. 401). The Corps also has authority to regulate Section 10 of the River and Harbor Act of 1899 (33 U.S.C. 403) which prohibits the alteration or obstruction of any navigable waterway with the excavation or deposition of fill material in such waterway.

Section 404 of the Clean Water Act (33 U.S.C. 1344) prohibits the unauthorized discharge of dredged or fill material into waters of the United States, including navigable waters. Such discharges require a permit. The term "discharges of fill material" means the addition of rock, sand, dirt, concrete, or other material into the waters of the United States incidental to construction of any structure. The Corps has granted a Nationwide General Permit for 26 categories of certain minor activities involving discharge of fill material.

Under the provisions of 33 CFR 330.5(a)(15), fill associated with construction of bridges across navigable waters of the United States, including cofferdams, abutments, foundation seals, piers, temporary construction and access fills are authorized under the Nationwide Section 404 Permit providing such fill has been permitted by the U. S. Coast Guard under Section 9 of the River and Harbor Act of 1899 as part of the bridge permit. Therefore, formal application of the Corps of Engineers for a Section 404 Permit is not required unless bridge approach embankment is located in a wetland area contiguous to said navigable stream. The Corps of Engineers has Section 404 regulatory authority over streams the Coast Guard has placed in the "advance approval" category. This category of navigable streams is defined as navigable in law but not actually navigated other than by logs, log rafts, rowboats, canoes and motorboats. Notably this regulation does not apply to the actual excavation or "dredging of material," provided this material is not

reintroduced into any regulated waterway including the one from which it was removed. Section 404 of the Clean Water Act (33 U.S.C. 1344) requires any applicant for a Federal permit for any activity that may affect the quality of waters of the United States to obtain water quality certification from the Tennessee Department of Environment and Conservation.

3. Federal Highway Administration. The Federal Highway Administration (FHWA) has the authority to implement the Section 404 Permit Program (Clean Water Act of 1977) for Federal-aid highway projects processed under 23 CFR 771.115 (b) categorical exclusions. This permit is granted for projects where the activity, work or discharge is categorically excluded from environmental documentation because such activity does not have individual or cumulative significant effect on the human environment.
4. Environmental Protection Agency. The Environmental Protection Agency (EPA) is authorized to prohibit the use of any area as a disposal site when it is determined that the discharge of materials at the site will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas (Section 404 (c)), Clean Water Act (33 U.S.C. 1344). Also EPA is authorized under the Section 402 of the Clean Water Act (33 U.S.C. 1344) to administer and issue a "National Pollutant Elimination Discharge System" (NPDES) permit for point source discharges, provided prescribed conditions are met.

Approval of bridge location, alignment, and appropriate navigational clearances is handled by the TDOT Hydraulic Design Section of the Structures Division.

2.02.2.3 FISH AND WILDLIFE SERVICE

The Fish and Wildlife Act of 1956 (16 U.S.C. 742 et seq.), the Migratory Game-Fish Act (16 U.S.C. 760c-760g) and the Fish and Wildlife Coordination Act (16 U.S.C. 611-666c) express the concern of Congress with the quality of the aquatic environment as it affects the conservation, improvement, and enjoyment of fish and wildlife resources. The Fish and Wildlife Coordination Act requires that:

“Whenever the waters of any stream or body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license, such department or agency shall first consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular state with a view to the conservation of wildlife resources by preventing loss of and damage to such resources as well as providing for the development and improvement thereof.”

The Fish and Wildlife Service's role in the permit review process is to review and comment on the effects of a proposal on fish and wildlife resources. The regulatory agency (e.g., Corps of Engineers, U.S. Coast Guard) is to consider and balance all factors, including anticipated benefits and costs in accordance with NEPA, in deciding whether to issue the permit (40 FR 55810, December 1, 1975).

2.02.2.4 NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

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 in order to qualify for flood insurance. These land use requirements could impose restrictions on the construction of highways in floodplains and floodways in communities which have qualified for flood insurance. A floodway, as used here and as used in connection 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 single year period without cumulatively increasing the water surface elevation more than 1 foot.

2.02.2.4.1 FLOOD INSURANCE

The National Flood Insurance Act of 1968, as amended, (42 U.S.C. 4001-4127) requires that communities 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.

1. 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 1 foot at any point within the community.
2. 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 1 foot 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 local community with land use jurisdiction, whether it is a city, county, or state, has the responsibility for enforcing National Flood Insurance Program 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 it be necessary. The highway agency should 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.

For additional information on land use requirements and National Flood Insurance Program regulations contact the TDOT Hydraulic Design Section of the Structures Division.

2.02.2.4.2 NATIONAL FLOOD INSURANCE PROGRAM 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. The following three types of NFIP maps are published:

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

A FHBM is generally not based on a detailed hydraulic study and, therefore, the floodplain boundaries shown are approximate. A FBFM, on the other hand, is generally derived from a detailed hydraulic study and should provide reasonably accurate information. The hydraulic data from which the FBFM was derived are available through the regional office of FEMA. This is normally in the form of computer input data records for calculating water surface profiles. The FIRM is generally produced at the same time using the same hydraulic model and has appropriate rate zones and base flood elevations added.

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.

2.02.2.4.3 FEDERAL EMERGENCY MANAGEMENT AGENCY COORDINATION

TDOT coordination with FEMA may arise 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:

- When a proposed crossing encroaches on a regulatory floodway and, as such, would require an amendment to the floodway map.
- When a proposed crossing encroaches on a floodplain where a detailed study has been performed but no floodway designated and the maximum 1 foot increase in the base flood elevation would be exceeded.
- When a local community is expected to enter into the regular program within a reasonable period and detailed floodplain studies are under way.
- When 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 1 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.

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. Coordination means furnishing to FEMA the draft EIS/EA and, upon selection of an alternative, furnishing to FEMA, through the community, a preliminary site plan and water surface elevation information and technical data in support of a floodway revision request as required. 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. The designer should be aware that projects processed with a categorical exclusion (CE) provide coordination during design. The outcome of the coordination could change the class of environmental processing.

All TDOT coordination with FEMA should be done through the Hydraulic Design Section.

2.02.2.4.4 FLOODWAYS

In many situations it is possible to design and construct highways in a cost effective 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. If a project element encroaches on the floodway but has a very minor 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, if hydraulic conditions can be improved so that no water surface elevation increase is reflected in the computer printout for the new conditions.

Where it is not cost-effective to design a highway crossing to avoid encroachment on an established floodway, a second alternative would be a modification of the floodway itself. Often, a 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 1 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 in order 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 may 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 currently 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.

Data submitted to FEMA, through the community, in support of a floodway revision request should include copies of the following:

- Current regulatory Flood Boundary Floodway Map, showing existing conditions, proposed highway crossing and revised floodway limits
- Computer printouts (input, computation, and output) for the current 100-year model and current 100-year floodway model

- Computer printouts (input, computation, and output) for the revised 100-year floodway model. Any fill or development that has occurred in the existing flood fringe area must be incorporated into the revised 100-year floodway model.
- Engineering certification is required for work performed by private subcontractors
- Many of the forms are available from FEMA and may be obtained by visiting their web site at <http://www.fema.gov>
- To contact a FEMA Flood Insurance Rate Map Specialist (FIRM) visit the FEMA web site at http://www.fema.gov/mit/tsd/fmc_main.htm
- For detailed FEMA issued Flood Maps visit the FEMA web site at <http://web1.msc.fema.gov/stores/MSC/>. These maps include Flood Hazard Boundary Maps (FHBM), Flood Insurance Rate Maps (FIRM), and Conversion Letters that are issued by FEMA.

The revised and current computer data required above should extend far enough upstream and downstream of the floodway revision area in order to tie back into the original floodway and profiles using sound hydraulic engineering practices. This distance will vary depending on the magnitude of the requested floodway revision and the hydraulic characteristics of the stream.

If input data representing the original hydraulic model are unavailable, an approximation should be developed. A new model should be established using the original cross section topographic information, where possible, and the discharges contained in the Flood Insurance Study which established the original floodway. The model should then be run confining the effective flow area to the currently established floodway and calibrated to reproduce within 0.10 feet of the "With Floodway" elevations provided in the Floodway Data Table for the current floodway. Floodway revisions may then be evaluated using the procedures outlined above.

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 1 foot maximum only when the following conditions have been met.

- A location hydraulic study has been performed in accordance with Federal Aid Highway Program Manual (FHPM) 6-7-3-2, FHWA, "Location and Hydraulic Design of Encroachments on Floodplains" (23 CFR 650, Subpart A) and FHWA finds the encroachment is the only practicable 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 1 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 which are insured under the Program and grandfathered in under the risk status existing prior to the construction of the structure.

- Prior to 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.

Highway Encroachment On A Floodplain With A Detailed Study (FIRM) - In communities where a detailed flood insurance study has been performed but no regulatory floodway designated, the highway crossing should be designed to allow no more than 1 foot increase in the base flood elevation based on technical data from the flood insurance study. Technical data supporting the increased flood elevation shall be submitted to the local community and through them to FEMA for their files.

Highway Encroachment On A Floodplain Indicated On A Flood Hazard Boundary Map - In communities where detailed flood insurance studies have not been performed, the highway agency must generate its own technical data to determine the base floodplain elevation and design encroachments in accordance with FHPM 6-7-3-2. Base floodplain elevations shall be furnished to the community, and coordination carried out with FEMA as outlined previously where the increase in base flood elevations in the vicinity of insurable buildings exceeds 1 foot.

Highway Encroachment on Unidentified Floodplains - Encroachments which are outside of NFIP communities or NFIP identified flood hazard areas should be designed in accordance with FHPM 6-7-3-2 of the Federal Highway Administration.

Levee Systems - For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive floodplain management criteria as outlined in the NFIP. The levee system must provide adequate protection from the base flood. Information supporting this must be supplied to FEMA by the community or other party seeking recognition of such a levee system at the time a flood risk study or restudy is conducted, when a map revision is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review will be for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and shall not constitute a determination by FEMA as to how a structure or system will perform in a flood event. For more information on the requirements related to levee systems see "National Flood Insurance Program and Related Regulations", Federal Emergency Management Agency, Revised, October 1, 1986 and Amended June 30, 1987 (44 CFR 65.10).

2.02.2.5 EXECUTIVE ORDERS

Presidential Executive Orders (E.O.) have the effect of law in the administration of programs by federal agencies. While executive orders do not directly apply to TDOT, these requirements are usually implemented through general regulations.

2.02.2.5.1 E.O. 11988 (FEDERAL AGENCY REQUIREMENTS)

Executive Order 11988, May 24, 1977, requires each federal agency, in carrying out its activities, to take the following actions:

- To 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.
- To evaluate the potential effect of any actions it may take in a floodplain, to ensure its planning programs reflect consideration of flood hazards and floodplain management.

These requirements are contained in the Federal-Aid Highway Program Manual (FHPM), Volume 6, Chapter 7, Section 3, Subsection 2, and were published in the *Federal Register*, April 26, 1979 (44 FR 24678), and in 23 CFR 650, Subpart A.

2.02.2.5.2 E.O. 11990 (WETLANDS)

Executive Order 11990, May 24, 1977, orders each Federal agency to:

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

These requirements are contained in 23 CFR 771 (FHPM 7-7-1).

2.02.2.6 STATE DRAINAGE LAW

State drainage law is derived mainly from two sources: common law and statutory law.

2.02.2.6.1 TYPES

Common Law - is that body of principles which developed from immemorial usage and custom and which receives judicial recognition and sanction through repeated application. These principles were developed without legislative action and are embodied in the decisions of the courts.

Statutory Laws of Drainage - are enacted by legislatures to enlarge, modify, clarify, or change the common law applicable to particular drainage conditions. This type of law is derived from constitutions, statutes, ordinances, and codes.

In general, the common law rules of drainage predominate unless they have been enlarged or superseded by statutory law.

2.02.2.6.2 CLASSIFICATION OF WATERS

The first step in the evaluation of a drainage problem is to classify the water as surface water, stream water, flood water, or ground water. These terms are defined below. Once the

classification has been established, the rule that applies to the particular class of water determines responsibilities with respect to disposition of the water.

Surface Waters - are those waters which have been precipitated on the land from the sky or forced to the surface in springs, and which have then spread over the surface of the ground without being collected into a definite body or channel.

Stream Waters - are former surface or ground waters which have entered and now flow in a well defined natural water course, together with other waters reaching the stream by direct precipitation or rising from springs in the bed or banks of the water course. A water course in the legal sense refers to a definite channel with bed and banks within which water flows either continuously or intermittently.

Flood Waters - are former stream waters which have escaped from a water course (and its overflow channels) and flow or stand over adjoining lands. They remain flood waters until they disappear from the surface by infiltration or evaporation, or return to a natural water course.

Ground Waters - In legal considerations, ground waters are divided into two classes, percolating waters and underground streams. The term "percolating waters" generally includes all waters which pass through the ground beneath the surface of the earth without a definite channel. The general rule is that all underground waters are presumed to be percolating and to take them out of the percolating class; the existence and course of a permanent channel must be clearly shown. Underground streams are waters passing through the ground beneath the surface in permanent, distinct, well-defined channels.

2.02.2.7 STATE WATER RULES

2.02.2.7.1 BASIC CONCEPTS

Two major rules have been developed by the courts regarding the disposition of surface waters. One is known as the civil law rule of natural drainage. The other is referred to as the common enemy doctrine. Modification of both rules has tended to bring them somewhat closer together, and in some cases the original rule has been replaced by a compromise rule known as the reasonable use rule. Much of the law regarding stream waters is founded on a common law maxim that states "water runs and ought to run as it is by natural law accustomed to run." Thus, as a general rule, any interference with the flow of a natural watercourse to the injury or damage of another will result in liability. This may involve augmentation, obstruction and detention, or diversion of a stream. However, there are qualifications:

1. In common law, flood waters are treated as a "common enemy" of all people, lands and property attacked or threatened by them.
2. In ground water law, the "English Rule," which is analogous to the common enemy rule in surface water law, is based on the doctrine of absolute ownership of water beneath the property by the landowner.

2.02.2.7.2 SURFACE WATERS

The civil law rule is based upon the perpetuation of natural drainage. The rule places a natural easement or servitude upon the lower land for the drainage of surface water in its

natural course and the natural flow of the water cannot be obstructed by the servient owner to the detriment of the dominant owner. Most states following this rule have modified it so that the owner of upper lands has an easement over lower lands for drainage of surface waters and natural drainage conditions can be altered by an upper proprietor provided the water is not sent down in a manner or quantity to do more harm than formerly.

Under the common enemy doctrine, surface water is regarded as a common enemy which each property owner may fight off or control as he will or is able, either by retention, diversion, repulsion, or altered transmission. Thus, there is not cause of action even if some injury occurs causing damage. In most jurisdictions, this doctrine has been subject to a limitation that one must use his land so as not to unreasonably or unnecessarily damage the property of others.

Under the reasonable use rule, each property owner can legally make reasonable use of his or her land, even though the flow of surface waters is altered thereby and causes some harm to others. However, liability attaches when the owner's harmful interference with the flow of surface water is "unreasonable." Whether a landowner's use is unreasonable is determined by a nuisance type-balancing test. The analysis involves the following questions:

1. Was there reasonable necessity for the actor to alter the drainage to make use of his land?
2. Was the alteration done in a reasonable manner?
3. Does the utility of the actor's conduct reasonably outweigh the gravity of harm to others?

2.02.2.7.3 STREAM WATERS

Where natural watercourses are unquestioned in fact and in permanence and stability, there is little difficulty in application of the rule. Highways cross channels on bridges or culverts, usually with some constriction of the width of the channel and obstruction by substructure within the channel, both causing backwater upstream and acceleration of flow downstream. The changes in regime must be so small as to be tolerable by adjoining owners, or there may be liability of any injuries or damages suffered.

Surface waters from highways are often discharged into the most convenient watercourse. The right is unquestioned if those waters were naturally tributary to the watercourse and unchallenged if the watercourse has adequate capacity. However, if all or part of the surface water has been diverted from another watershed to a small watercourse, any lower owner may complain and recover for ensuing damage.

2.02.2.7.4 FLOOD WATERS

Considering flood waters as a common enemy permits all affected land-owners including owners of highways, to act in any reasonable way to protect themselves and their property from the common enemy. They may obstruct its flow from entering their land, backing or diverting water onto lands of another without penalty, by gravity or pumping, by diverting dikes or ditches, or by any other reasonable means.

Again, the test of "reasonableness" has frequently been applied, and liability can result where unnecessary damage is caused. Ordinarily, the highway designer should make provision for overflow in areas where it is foreseeable that it will occur. There is a definite risk of liability if such waters are impounded on an upper owner or, worse yet, are diverted into an area where they would not otherwise have gone. Merely to label waters as "flood waters" does not mean that they can be disregarded.

The "English Rule" has been modified by the "Reasonable Use Rule" which states in essence that each landowner is restricted to a reasonable exercise of his own right and a reasonable use of his property in view of the similar right of his neighbors.

The key word is "reasonable." While this may be interpreted somewhat differently from case to case, it can generally be taken to mean that a landowner can utilize subsurface water on his property for the benefit of agriculture, manufacturing, irrigation, etc. pursuant to the reasonable development of his property although such action may interfere with the underground waters of neighboring proprietors. However, it does generally preclude the withdrawal of underground waters for distribution or sale for uses not connected with any beneficial owner-ship or enjoyment of the land from whence they were taken.

A further interpretation of "reasonable" in relation to highway construction would view the excavation of a deep "cut section" that intercepts or diverts underground water to the detriment of adjacent property owners as unreasonable. There are also cases where highway construction has permitted the introduction of surface contamination into subsurface waters and thus incurred liability for resulting damages.

2.02.2.8 STATUTORY LAW

The inadequacies of the common law or court-made laws of drainage led to a gradual enlargement and modification of the common law rules by legislative mandate. In the absence of statute, the common law rules adopted by State courts determine surface water drainage rights. If the common law rules have been enlarged or superseded by statutory law, the statute prevails. In general, statutes have been enacted that affect drainage in one way or another in the subject areas described below.

2.02.2.8.1 EMINENT DOMAIN

In the absence of existing right, public agencies may acquire the right to discharge highway drainage across adjoining lands through the use of the right of eminent domain. Eminent domain is the power of public agencies to take private property for public use.

The Tennessee State Constitution grants TDOT the right of eminent domain which allows for taking of property for public purposes, including the development of watercourse and watershed areas. However, whenever any property is taken under eminent domain, the private landowner must be compensated for the loss.

2.02.2.8.2 WATER RIGHTS

The water right which attaches to a watercourse is a right to the use of the flow, not ownership of the water itself. This is true under both the riparian doctrine and the appropriation doctrine. This right of use is a property right, entitled to protection to the same extent as other

forms of property, and is regarded as real property. After the water has been diverted from the stream flow and reduced to possession, the water itself becomes the personal property of the riparian owner or the appropriator.

Riparian Doctrine - Under the riparian doctrine, lands contiguous to watercourses have prior claim to waters of the stream solely by reason of location and regardless of the relative productive capacities of riparian and non-riparian lands.

Doctrine of Prior Appropriation - The essence of this doctrine is the exclusive right to divert water from a source when the water supply naturally available is not sufficient for the needs of all those holding rights to its use. Such exclusive right depends upon the effective date of the appropriation, the first in time being the first in right.

Generally, the highway designer must consider that proposed work in the vicinity of a stream should not impair either the quality or quantity of flow of any water rights to the stream.

2.02.2.9 LOCAL LAWS AND APPLICATIONS

Local governments (cities, counties, and improvement districts) have ordinances and codes which require consideration during design. This is described further in the section on Policy (2.02.3.3).

A municipality is generally treated like a private party in State drainage matters. A municipality undertaking a public improvement is liable like an individual for damage resulting from negligence or an omission of duty. As a general rule, municipalities are under no legal duty to construct drainage improvements unless public improvements necessitate drainage - as in those situations in which street grading and paving or construction accelerate or alter storm runoff. In addition, it is generally held that municipalities are not liable for adoption or selection of a defective plan of drainage.

Municipalities can be held liable for negligent construction of drainage improvements, for negligent maintenance and repair of drainage improvements and failing to provide a proper outlet for drainage improvements. In general, in the absence of negligence a municipality will not be held liable for increased runoff occasioned by the necessary and desirable construction of storm drains. Nor will a municipality be held liable for damages caused by overflow of its storm drains occasioned by extraordinary, unforeseeable rains or floods. Municipal liability will attach where a municipality:

- Collects surface water and casts it in a body onto private property where it did not formerly flow
- Diverts, by means of artificial drains, surface water from the course it would otherwise have taken, and casts it in a body large enough to do substantial injury on private land, where, but for the artificial storm drain, it would not go.
- Fills up, dams back, or otherwise diverts a stream of running water so that it overflows its banks and flows on the land of another.

2.02.3 POLICIES

2.02.3.1 GENERAL POLICIES

Two policies define an adequate drainage structure. The first policy is that the design of the structure meets or exceeds TDOT's standard engineering practice. The second policy is that the design is consistent with what a reasonably competent and prudent designer would do under similar circumstances. To achieve an adequate drainage design, normally a hydrologic and hydraulic analysis and an engineering evaluation of selected alternatives are conducted. The drainage design process includes the following policies:

- Drainage design, such as stormwater retention/detention, can be a highly complex technical process and should be prepared and sealed by professional engineer competent to provide this design and perform the necessary calculations.
- The designer is responsible to provide an adequate drainage structure. The designer is not required to provide a structure that will handle all conceivable flood flows under all possible site conditions.
- The detail of the design should be commensurate with the risks associated with the encroachment and with other economic, engineering, social, or environmental concerns.
- The overtopping and/or design flood may serve as criteria for evaluating the adequacy of a proposed design. The overtopping flood and the design flood may vary widely depending on the grade, alignment, and classification of the road and the characteristics of the watercourse and floodplain.
- The predicted value of the 100-year or base flood serves as the present engineering standard for evaluating flood hazards and as the basis for regulating floodplains under the National Flood Insurance Program. The designer must make a professional judgment as to the degree of risk that is tolerable for the base flood on a case-by-case basis.
- In the early planning stages, a project should be screened for the potential to impact downstream systems. The evaluation criteria found in Chapter 8 Storm Water Storage Facilities may be used in the screening of potential impacts.

2.02.3.2 FEDERAL POLICIES

The following sections list the Federal legislation containing the Federal policies which may affect drainage design and construction. These sections give the legislative reference, regulations reference, purpose, applicability, general procedures and agency for coordination and consultation. For more detailed information about specific Federal policies, the applicable legislation should be consulted.

2.02.3.2.1 ENVIRONMENTAL LEGISLATION

1. National Environmental Policy Act: 42 U.S.C. 4321-4347 (P.L. 91-190 and 94-81). Reference - 23 CFR 770-772, 40 CFR 1500-1508, CEQ Regulations, Executive Order 11514 as amended by Executive Order 11991 on NEPA responsibilities.
Purpose - consider environmental factors through systematic interdisciplinary approach before committing to a course of action.
Applicability - all highway projects.
General Procedures - Procedures set forth in CEQ regulations and 23 CFR 771.
Coordination - appropriate Federal, State, and local agencies.

2. Section 4(f) of the Department of Transportation Act: 23 U.S.C. 138, 49 U.S.C. 303 (P.L. 100-17, 97-449, and 86-670), 23 CFR 771.135.
Purpose - preserve publicly owned public parklands, waterfowl and wildlife refuges, and all historic areas.
Applicability - significant publicly owned public parklands, recreation areas, wildlife and waterfowl refuges, and all significant historic sites used for a highway project.
General Procedures - specific finding required: (1) selected alternative should avoid protected areas, unless not feasible or prudent; and (2) includes all possible planning to minimize harm.
Coordination - DOI, DOA, HUD, state, or local agencies having jurisdiction, and State Historic Preservation Officer (for historic sites).

3. Economic, Social, and Environmental Effects: 23 U.S.C. 109(h) (P.L. 91- 605), 23 U.S.C. 128, 23 CFR 771.
Purpose - to assure that possible adverse, economic, social, and environmental effects of proposed highway projects and project locations are fully considered, and that final decisions on highway projects are made in the best overall public interest.
Applicability - to the planning and development of proposed projects on any Federal-aid system for which the FHWA approves the plans, specifications, and estimates, or has the responsibility for approving a program.
General Procedures - identification of social, economic, and environmental effects; consideration of alternative courses of action; involvement of other agencies and the public; systematic interdisciplinary approach. The report required by Section 128, on the consideration given to the social, economic and environmental impacts of the project, may serve as part of the NEPA compliance document.
Coordination - appropriate Federal, State, and local agencies.

4. Public Hearings: 23 U.S.C. 128, 23 CFR 771.111.
Purpose - to ensure adequate opportunity for public hearing(s) on the social, economic and environmental effects of alternative project locations and major design features, as well as the consistency of the project with local planning goals and objectives.
Applicability - public hearings or hearing opportunities are required for projects described in each State's FHWA approved public involvement procedures.
General Procedures - public hearings or opportunities for public hearings during the consideration of highway location and design proposals are conducted as described in the State's FHWA-approved, public involvement procedures. States must certify to FHWA that such hearings or the opportunity therefore have been held and must submit a hearing transcript to FHWA.
Coordination - appropriate Federal, State, and local agencies.

5. Surface Transportation and Uniform Relocation Assistance Act of 1987: Section 123(f) Historic Bridges 23 U.S.C. 144(o) (P.L. 100-17).
Purpose - complete an inventory of on-and-off system bridges to determine their historic significance. Encourage the rehabilitation, reuse, and preservation of historic bridges.
Applicability - any bridge that is listed on, or eligible for listing on, the National Register of Historic Places.
General Procedures - (1) identify historic bridges on and off system, (2) seek to preserve or reduce impact to historic bridges, and (3) seek a recipient prior to demolition.
Coordination - State Historic Preservation Officer and Advisory Council on Historic Preservation.

6. Surface Transportation and Uniform Relocation Assistance Act of 1987: Section 130 Wildflowers, 23 U.S.C. 319(b) (P.L. 100-17), FHPM 6-2-5-1, 23 CFR 752.
Purpose - to encourage the use of native wildflowers in highway landscaping.
Applicability - wildflowers are to be planted on any landscaping project undertaken on the Federal-aid highway system.
General Procedures - at least 1/4 of 1% of funds expended on a landscaping project must be used to plant wildflowers on that project.
Coordination - appropriate Federal and State agencies.

2.02.3.2.2 HEALTH

1. Safe Drinking Water Act: 42 U.S.C. 300f - 300j-6 (P.L. 93-523 and 99-339), FHPM 6-7-3-3, 23 CFR 650, Subpart E, 40 CFR 141,149.
Purpose - ensure public health and welfare through safe drinking water.
Applicability - (1) all public drinking water systems and reservoirs (including rest area facilities), (2) actions which may have a significant impact on an aquifer or wellhead protection area which is the sole or principal drinking water source, as designated through the *Federal Register* process.
General Procedures - (1) compliance with national primary drinking water regulations, (2) compliance with State wellhead protection plans, (3) compliance with MOAs between EPA and FHWA covering specific sole source aquifers.
Coordination - EPA and appropriate State agency.

2. Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976: 42 U.S.C. 6901, et seq., see especially 42 U.S.C. 6961-6964 (P.L. 89-272, 91(P.L. 89-272, 91-512, and 94-580), 23 CFR 751, 40 CFR 256-300.
Purpose - provide for the recovery, recycling, and environmentally safe disposal of solid wastes.
Applicability - all projects which necessitate the disposal of solid wastes.
General Procedures - solid wastes will be disposed of according to the rules for specific waste involved.
Coordination - EPA.

3. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): 7 U.S.C. 136-136y (P.L. 92-516), 40 CFR 162-171.
Purpose - control the application of pesticides to provide greater protection to man and the environment.

Applicability - all activities which necessitate use of restricted pesticides.

General Procedures - using or supervising "restricted use" pesticides will require certification.

Coordination - EPA.

2.02.3.2.3 HISTORIC AND ARCHEOLOGICAL PRESERVATION

1. Section 106 of the National Historic Preservation Act, as amended: 16 U.S.C. 470f (P.L. 89-665, 91-243, 93-54, 94-422, 94-458, 96-199, 96-244, and 96-515), Executive Order 11593, 23 CFR 771, 36 CFR 60, 36 CFR 63, 36 CFR 800.

Purpose - protect, rehabilitate, restore, and reuse districts, sites buildings, structures, and objects significant in American architecture, archeology, engineering, and culture.

Applicability - all properties on or eligible for inclusion on the National Register of Historic Places.

General Procedures - (1) identify and determine the effects of project on subject properties, (2) afford Advisory Council an early opportunity to comment, in accordance with 36 CFR 800, (3) avoid or mitigate damages to greatest extent possible.

Coordination - State Historic Preservation Officer, Advisory Council on Historic Preservation, DOI (NPS).

2. Section 110 of the National Historic Preservation Act, as amended: 16 U.S.C. 470h-2 (P.L. 96-515), 36 CFR 65, 36 CFR 78.

Purpose - protect national historic landmarks and record historic properties prior to demolition.

Applicability - all properties designated as National Historic Landmarks. All properties on or eligible for inclusion on the National Register of Historic Places.

General Procedures - (1) identify and determine the effects of a project on subject properties, (2) afford Advisory Council an early opportunity to comment, in accordance with 36 CFR 800.

Coordination - State Historic Preservation Officer, Advisory Council on Historic Preservation, DOI (NPS).

3. Archeological and Historic Preservation Act: 16 U.S.C. 469-469c (P.L. 93-291) (Moss-Bennett Act), 36 CFR 66 (draft).

Purpose - preserving significant historical and archeological data from loss or destruction.

Applicability - any archeological resources discovered as a result of a Federal construction project or federally licensed activity or program.

General Procedures - (1) notify DOI (NPS) when a Federal project may result in the loss or destruction of a historic or archeological property, (2) DOI and/or the Federal agency may undertake survey or data recovery.

Coordination - DOI (NPS) departmental consulting archeologist and State Historic Preservation Officer.

4. Act for the Preservation of American Antiquities: 16 U.S.C. 431-433 (P.L. 59-209), 36 CFR 251.50-.64, 43 CFR 3. Archeological Resources Protection Act: 16 U.S.C. 470aa-11 (P.L. 96-95), 18 CFR 1312, 32 CFR 229, 36 CFR 296, 43 CFR 7.

Purpose - preserve and protect paleontological resources, historic monuments, memorials, and antiquities from loss or destruction.

Applicability - archeological resources on federally or Indian owned property.

General Procedures - (1) ensure contractor obtains permit, and identifies and evaluates resource, (2) mitigate or avoid resource in consultation with appropriate officials in the State, (3) if necessary, apply for permission to examine, remove, or excavate such objects.

Coordination - Department or agency having jurisdiction over land on which resources may be situated (BIA, BLM, DOA, DOD, NPS, TVA, USFS), State Historic Preservation Officer, recognized Indian tribe, if appropriate.

5. American Indian Religious Freedom Act: 42 U.S.C. 1996 (P.L. 95-341).

Purpose - protect places of religious importance to American Indians, Eskimos, and Native Hawaiians.

Applicability - all projects which affect places of religious importance to Native Americans.

General Procedures - consult with knowledgeable sources to identify and determine any effects on places of religious importance. Comply with Section 106 procedures if the property is historic.

Coordination - BIA, State Historic Preservation Officer, State Indian liaison, Advisory Council on historic Preservation, if appropriate.

2.02.3.2.4 LAND AND WATER USAGE

1. Wilderness Act: 16 U.S.C. 1131-1136, 36 CFR 251, 293, 43 CFR 19, 8560, 50 CFR 35.

Purpose - preserve and protect wilderness areas in their natural condition for use and enjoyment by present and future generations.

Applicability - all lands designated as part of the wilderness system by Congress.

General Procedures - apply for modification or adjustment of wilderness boundary by either Secretary of the Interior or Agriculture, as appropriate.

Coordination - Agriculture (USFS), DOI (FWS, NPS, BLM), and State agencies.

2. Wild and Scenic Rivers Act: 16 U.S.C. 1271-1287, 36 CFR 251, 261, 43 CFR 8350.

Purpose - preserve and protect wild and scenic rivers and immediate environments for benefit of present and future generations.

Applicability - all projects which affect designated and potential wild, scenic, and recreational rivers, and/or immediate environments.

General Procedures - submit project plans and reports to appropriate Federal agency.

Coordination - DOI (NPS) and/or Agriculture (USFS), State agencies.

3. Land and Water Conservation Fund Act (Section 6(f)): 16 U.S.C. 460l-4 to l-11 (P.L. 88-578).

Purpose - preserve, develop, and assure the quality and quantity of outdoor recreation resources for present and future generations.

Applicability - all projects which impact recreational lands purchased or improved with land and water conservation funds.

General Procedures - the Secretary of the Interior must approve any conversion of property acquired or developed with assistance under this act to other than public, outdoor recreation use.

Coordination - DOI, State agencies.

4. Executive Order 11990, Protection of Wetlands, DOT Order 5660.1A, 23 CFR 777.

- Purpose - to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.
- Applicability - federally undertaken, financed, or assisted construction, and improvements in or with significant impacts on wetlands.
- General Procedures - evaluate and mitigate impacts on wetlands. Specific finding required in final environmental document.
- Coordination - DOI (FWS), EPA, USCE, NMFS, NRCS, State agencies.
5. Emergency Wetlands Resources Act of 1986: 16 U.S.C. - 3901 note (P.L. 99-645).
Purpose - to promote the conservation of wetlands in the U. S. in order to maintain the public benefits they provide.
Applicability - all projects which may impact wetlands.
General Procedures - (1) preparation of a National Wetlands Priority Conservation Plan which provides priority with respect to Federal and State acquisition, (2) provides direction for the National Wetlands Inventory Project.
Coordination - FWS.
 6. National Trails Systems Act: 16 U.S.C. 1241-1249, 36 CFR 251, 43 CFR 8350.
Purpose - provide for outdoor recreation needs and encourage outdoor recreation.
Applicability - projects affecting national recreational, scenic, or side trails designated by Congress and lands through which such trails pass.
General Procedures - (1) apply for right-of-way easement from the Secretary of Interior or Agriculture, as appropriate, (2) ensure that potential trail properties are made available for use as recreational and scenic trails.
Coordination - DOI (NPS) or Agriculture (USFS).
 7. Rivers and Harbors Act of 1899: 33 U.S.C. 401, et seq., as amended and supplemented, 23 CFR part 650, Subpart H, 33 CFR 114-115.
Purpose - protection of navigable waters in the U.S.
Applicability - any construction affecting navigable waters and any obstruction, excavation, or filling.
General Procedures - must obtain approval of plans for construction, dumping, and dredging permits (Section 10) and bridge permits (Section 9).
Coordination - USCE, USCG, EPA, State agencies.
 8. Federal Water Pollution Control Act (1972), as amended by the Clean Water Act (1977 & 1987): 33 U.S.C. 1251-1376 (P.L. 92-500, 95-217, 100-4), DOT Order 5660.1A, FHWA Notices N5000.3 and N5000.4, FHPM 6-7-3-3, 23 CFR 650, Subpart B, E, 771, 33 CFR 209, 40 CFR 120, 122-125, 128-131, 133, 125-136, 148, 230-231.
Purpose - restore and maintain chemical, physical, and biological integrity of the Nation's waters through prevention, reduction, and elimination of pollution.
Applicability - any discharge of a pollutant into waters of the U.S.
General Procedures - (1) obtain permit for dredge or fill material from USCE or State agency, as appropriate (Section 404), (2) permits for all other discharges are to be acquired from EPA or appropriate State agency (Section 402), (3) water quality certification is required from State water resource agency (Section 401), (4) all projects shall be consistent with the State non-point source pollution management program (Section 319).
Coordination - USCE, EPA, designated State water quality control agency, designated State non-point source pollution agency.

9. Executive Order 11988, Floodplain Management, as amended by Executive Order 12148, DOT Order 5650.2, FHPM 6-7-3-2, 23 CFR 650, Subpart A, 771.
Purpose - to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to restore and preserve the natural and beneficial values served by floodplains.
Applicability - all construction of Federal or federally aided buildings, structures, roads, or facilities which encroach upon or affect the base floodplain.
General Procedures - (1) assessment of flood hazards, (2) specific finding required in final environmental document.
Coordination - FEMA, State and local agencies.

10. National Flood Insurance Act: (P.L. 90-448), Flood Disaster Protection Act: (P.L. 93-234) 42 U.S.C. 4001-4128, DOT Order 5650.2, FHPM 6-7-3-2, 23 CFR 650, Subpart A, 771, 44 CFR 59-77.
Purpose - (1) identify flood-prone areas and provide insurance, (2) requires purchase of insurance for buildings in special flood hazard areas.
Applicability - any federally assisted acquisition of construction project in area identified as having special flood hazards.
General Procedures - avoid construction in, or design to be consistent with, FEMA-identified flood-hazard areas.
Coordination - FEMA, State and local agencies.

11. Water Bank Act: 16 U.S.C. (P.L. 91-559, 96-182), 7 CFR 752.
Purpose - preserve, restore, and improve wetlands of the Nation.
Applicability - any agreements with landowners and operators in important migratory waterfowl nesting and breeding areas.
General Procedures - apply procedures established for implementing Executive Order 11990.
Coordination - Secretary of Agriculture, Secretary of Interior.

12. Farmland Protection Policy Act of 1981: 7 U.S.C. 4201-4209 (P.L. 97-98, 99-198), 7 CFR 658.
Purpose - minimize impacts on farmland and maximize compatibility with State and local farmland programs and policies.
Applicability - all projects that take right-of-way in farmland.
General Procedures - (1) early coordination with the NRCS, (2) land evaluation and site assessment, (3) determination on whether or not to proceed with farmland conversion, based on severity of impacts and other environmental considerations.
Coordination - NRCS.

13. Resource Conservation and Recovery Act of 1976 (RCRA), as amended: 42 U.S.C. 690, et seq. (P.L. 94-580, 98-616), 40 CFR 260-271.
Purpose - protect human health and the environment, prohibit open dumping, manage solid wastes, regulate treatment, storage, transportation, and disposal of hazardous waste.
Applicability - any project that takes right-of-way containing a hazardous waste.
General Procedures - coordinate with EPA or State agency on remedial action.
Coordination - EPA or State agency approved by EPA, if any.

14. Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended: 42 U.S.C. 9601-9657 (P.L. 96-510), 40 CFR 300, 43 CFR 11. Superfund Amendments and Reauthorization Act of 1986 (SARA) (P.L. 99-499).
Purpose - provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites.
Applicability - any project that might take right-of-way containing a hazardous substance.
General Procedures - (1) avoid hazardous waste sites, if possible, (2) check EPA lists of hazardous waste sites, (3) field surveys and reviews of past and present land use, (4) contact appropriate officials if uncertainty exists, (5) if hazardous waste is present or suspected, coordinate with appropriate officials, (6) if hazardous waste encountered during construction, stop project and develop remedial action.
Coordination - EPA or State agency approved by EPA, if any.
15. Endangered Species Act of 1973, as amended: 16 U.S.C. 1531-1543 (P.L. 93-205, 94-359, 95-632, 96-159, 97-304), 7 CFR 355, 50 CFR 17, 23, 25-29, 81, 217, 222, 225-227, 402, 424, 450-453.
Purpose - conserve species of fish, wildlife and plants facing extinction.
Applicability - any action that is likely to jeopardize continued existence of such endangered/threatened species or result in destruction or modification of critical habitat.
General Procedures - consult with the Secretary of the Interior or Commerce, as appropriate.
Coordination - DOI (FWS), Commerce (NMFS).
16. Fish and Wildlife Coordination Act: 16 U.S.C. 661-666c (P.L. 85-624, 89-72, 95-616).
Purpose - conservation, maintenance, and management of wildlife resources.
Applicability - (1) any project which involves impoundment (surface area of 4.05 hectares or more), diversion, channel deepening, or other modification of a stream or other body of water, (2) transfer of property by Federal agencies to State agencies for wildlife conservation purpose.
General Procedures - coordinate early in project development with FWS and State fish and wildlife agency.
Coordination - DOI (FWS), State fish and wildlife agencies.

2.02.3.3 TDOT DRAINAGE PROCEDURES AND RESPONSIBILITIES

TDOT procedures and responsibilities are described in this section. The drainage designer should check in the particular chapter that deals with each drainage item for further details on TDOT's policies, procedures, practices, and responsibilities.

2.02.3.3.1 SIZING BRIDGE WATERWAY OPENINGS

When drainage area runoff flows for 2% exceedance (Q_{50}) is more than 500 cfs or for any structure whose length along the roadway (width of structure) is 20 feet or greater, the Hydraulics Design Section of the Structures Division will furnish all necessary data and hydraulic design to be shown on the plans.

2.02.3.3.2 HYDROLOGIC RESPONSIBILITIES

Roadway improvements within TDOT lands and rights-of-way should be done through sound, reasonable, and acceptable engineering practices which may include augmented or accelerated flow caused by TDOT improvements unless determined to cause unreasonable and substantial damages. TDOT expects the same practice and acceptance of responsibility by other property owners and those engaged in the development of property. TDOT does not have the responsibility for eliminating flooding on private property that is not attributable to acts of TDOT or its representatives.

2.02.3.3.3 DIVERSIONS

Altering the path of surface waters from one drainage area to another is a diversion. Many diversions are made through the use of ditches and open channels; others may be accomplished through closed drainage systems. TDOT practice for drainage system design and maintenance is that diversions be avoided insofar as practical from good engineering practice.

Any person(s) desiring to create a diversion into any TDOT property or right-of-way shall do so only after receiving written permission from TDOT. Permission will be granted only after determination that the diversion flow can be properly handled without damage to the highway and highway drainage system. If any adjustments to the TDOT drainage system are required, the cost will be borne by the requester, and that appropriate consideration and measures have been taken to indemnify and save harmless TDOT from potential downstream damage claims. TDOT will not become a party to diversions unless refusal would create a considerable and real hardship to the requesting party.

2.02.3.3.4 DITCHES AND OPEN CHANNELS

Preventive measures against soil erosion and protection of the environment must be considered and are presented in Chapter 10 of this Manual. Allowable high water elevations for design are identified in Chapter 5 of this Manual.

2.02.3.3.5 STORM DRAINS

The pipe size requirements for sub-surface culverts and storm drains are provided in Chapters 6 and 7 of this Manual, respectively. No alteration, attachment, extension, nor addition of appurtenance to any culvert, storm sewer, or other drainage structure shall be allowed on highway rights-of-way without written permission from TDOT.

2.02.3.3.6 EROSION AND SEDIMENT CONTROL

Temporary and permanent erosion prevention and sediment control procedures and responsibilities are included in Chapter 10 of this Manual. Refer to Chapter 10 for TDOT procedures and responsibilities regarding erosion prevention and sediment control.

2.02.3.3.7 FLOODPLAIN ENCROACHMENTS

Longitudinal encroachments are to be avoided when possible. If such an encroachment cannot be avoided, the degree of encroachment should be minimized to the greatest extent possible. Transverse encroachments generally cannot be avoided (except for a no-build

alternative). The design selected for transverse encroachments should be supported by analysis of design alternatives with consideration given to cost, risk, and potential impacts. "Supported" means that the design is either shown to be cost-effective or justified by another engineering basis.

2.02.3.3.8 IMPROVEMENTS AND MAINTENANCE

1. Improvements and maintenance of drainage *within* the R.O.W.
 - Open channels, ditches, and drainage structures shall be maintained at a functioning level such that they do not present an unreasonable level of damage potential for the roadway or adjacent properties.
 - Where the size of an existing roadway culvert is determined to be of unacceptable adequacy in regard to the roadway drainage system as a result of a single action or development, the party responsible for the action or development will bear the cost of replacement.
 - No alteration, attachment, extension, nor addition of appurtenance to any culvert, storm sewer, or other drainage structure shall be permitted within TDOT right-of-way without written permission from TDOT.

2. Improvements and maintenance of drainage *outside* of the R.O.W.
 - Drainage involvement outside TDOT right-of-way is limited to two general areas of justification:
 - TDOT would benefit by such an involvement. Benefits that may warrant the cost include would include improvements that reduce the roadway flood frequency, reduce the extent of roadway flooding, facilitates maintenance, or reduces potential damages to TDOT property.
 - TDOT is required to correct a problem or condition created by some action of TDOT.

2.02.3.3.9 EASEMENTS

Structural features including items such as inlets, catch basins and pipe ends should be contained in a permanent easement if right-of-way is not available. If runoff is discharged from TDOT right-of-way at a point where there is no natural drain or existing ditch, a permanent drainage easement is required to allow construction of a ditch or channel to convey the discharge to an acceptable natural outlet. A permanent drainage easement would be required to discharge runoff into a natural drain or existing ditch where the increase in flow exceeds the capacity of the drain or ditch or otherwise creates a problem. The permanent drainage easement would allow enlarging or otherwise improving the drain to a point where the increased discharge would not cause damage.

2.02.3.4 DESIGNER'S RESPONSIBILITY

The designer is responsible for following the policies, criteria, procedures, and practices identified in this Drainage Manual and TDOT's other manuals, with sections relevant to drainage design. In addition to TDOT publications, other drainage information and reference sources are available for the designer. The designer shall use his or her knowledge and judgment to hold paramount the safety, health, and welfare of the public while acting as a faithful agent or trustee to TDOT.

The legal aspects of highway drainage are two-fold for the designer.

1. The designer should know the legal principles involved and apply this knowledge to the design.
2. If legal actions are anticipated on a project, the designer should work closely with the legal staff of his or her organization in the preparation and trial of drainage cases.

2.02.3.5 LOCAL/MUNICIPAL POLICIES

Many local governmental bodies in Tennessee have developed ordinances, codes, guidelines, or other requirements that may influence roadway drainage design. Generally, the State is not legally required to comply with local ordinances except where compliance is required by specific State statute. However, TDOT may consider, as practical, conforming to local ordinances as a courtesy, especially when it can be done without imposing a burden on the State.

SECTION 2.03 – FIELD RECONNAISSANCE

In order for the designer to properly understand the drainage characteristics of the project location, a field reconnaissance is appropriate. The surveyor for the project will have identified many of the drainage features within the project limits. This information is included in the survey data. The designer should review the survey data and perform a field reconnaissance to verify the data and to become familiar with the project's drainage features. The drainage related items included in the survey are identified in the *TDOT Survey Manual*. The field reconnaissance should be performed early in the design of the project.

For projects that involve stream relocations, specifically those that are to be designed using natural stream design (NSD), the designer should refer to Section 11.03.4 of this Manual for obtaining additional field information required to complete an NSD design.

TDOT DESIGN DIVISION

DRAINAGE MANUAL

CHAPTER II

APPENDIX 2A

SECTION 2.04 – APPENDIX

2.04.1 REFERENCES

American Association of State Highway and Transportation Officials. *Model Drainage Manual [Metric Edition]*. Washington, D.C. 1999.

Hankins, Jr., A.L. *Guidelines for Drainage Studies and Hydraulic Design North Carolina Department of Transportation*. Raleigh, NC. 1999.

Illinois Department of Transportation. *Departmental Policy BBS-7 Drainage Manual*. Springfield, IL. 1989.

Indiana Department of Transportation. *Indiana Design Manual Part IV Volume I*. Indianapolis, IN. 1999.

Tennessee Department of Transportation. *Design Guidelines - English*. Nashville, TN. May, 2012.

2.04.2 ABBREVIATIONS

Following are the abbreviations used in the descriptions of Federal policies:

BIA - Bureau of Indian Affairs
BLM - Bureau of Land Management
CEQ - Council on Environmental Quality
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations (CFR)
DOA - Department of the Army
DOD - Department of Defense
DOI - Department of the Interior
DOT - Department of Transportation
EPA - Environmental Protection Agency
FEMA - Federal Emergency Management Agency
FHPM - Federal-Aid Highway Program Manual
FHWA - Federal Highway Administration
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
FWPCA - Federal Water Pollution Control Act
FEIS - Final Environmental Impact Statement
FWS - Fish and Wildlife Service
HUD - Housing and Urban Development
NFIP - National Flood Insurance Program
NMFS - National Marine Fisheries Service
NPS - National Park Service
NRCS - National Resource Conservation Service; formerly Soil Conservation Service (SCS)
P.L. - Public Law
RCRA - Resource Conservation and Recovery Act
SARA - Superfund Amendments and Reauthorization Act
SEE - Social, Economic, and Environmental
SIP - State Implementation Plan
TVA - Tennessee Valley Authority
UMTA - Urban Mass Transportation Administration
U.S.C. - United States Code
USCE - U.S. Corps of Engineers
USCG - U.S. Coast Guard
USFS - U.S. Forest Service