

# Chapter 3

## POLICY

ODOT ROADWAY DRAINAGE MANUAL

*November 2014*



**Chapter 3**  
**POLICY**

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# Chapter 3

## POLICY

### 3.1 INTRODUCTION

#### 3.1.1 Purpose

Drainage concerns are one of the most important aspects of highway design and construction. This Chapter outlines specific policies that provide an appropriate level of consideration for the multitude of variables that influence drainage design.

#### 3.1.2 Policy vs. Criteria

Policy and criteria statements are frequently closely related. Criteria are ODOTs numerical or specific guidance, which is founded in broad policy statements. For this *Manual*, the following definitions of policy and criteria will be used:

1. Policy. A definite course of action or method of action, selected to guide and determine present and future decisions. The following is an example of a policy statement:

*“The hydraulics designer should size the drainage structure to accommodate a flood compatible with the ODOT roadway functional classification.”*

2. Design Criteria. The standards by which a policy is implemented or placed in action. Thus, design criteria are needed for design; policy statements are not. The design criteria for designing the structure might be:

*“For Rural Collector System with Average Daily Traffic (AADT) =< 3,000 Vehicles Per Day (VPD), drainage structures should be designed for a 10-year flood (exceedance probability – 10%). For Rural Collector System with Average Daily Traffic (AADT) > 3,000 Vehicles Per Day (VPD), drainage structures should be designed for a 25-year flood (exceedance probability – 4%).”*

#### 3.1.3 Chapter Outline

The remainder of this Chapter presents information concerning the hydraulic design of drainage structures and related Federal, State and local policies. Some sections will be limited to outlining the relevant policies (with references indicating where details can be obtained); other sections will state the policies and give more detailed information.

### 3.1.4 **Acronyms**

Following are the acronyms for Federal agencies and selected laws used throughout the *Manual*:

BIA	—	Bureau of Indian Affairs
BLM	—	Bureau of Land Management
CEQ	—	Council on Environmental Quality
CERCLA	—	<i>Comprehensive Environmental Response, Compensation and Liability Act</i>
CFR	—	<i>Code of Federal Regulations</i>
DOA	—	Department of the Army
DOD	—	Department of Defense
DOI	—	Department of the Interior
DOT	—	Department of Transportation
FEMA	—	Federal Emergency Management Agency
FHWA	—	Federal Highway Administration
FIFRA	—	<i>Federal Insecticide, Fungicide and Rodenticide Act</i>
FWPCA	—	<i>Federal Water Pollution Control Act</i>
MPO	—	Metropolitan Planning Organization
NMFS	—	National Marine Fisheries Service
NPDES	—	National Pollutant Discharge Elimination System
NPS	—	National Park Service
NRCS	—	Natural Resources Conservation Service
P.L.	—	Public Law
RCRA	—	<i>Resource Conservation and Recovery Act</i>
SARA	—	<i>Superfund Amendments and Reauthorization Act</i>
SEE	—	Social, Economic and Environmental Factors
SIP	—	State Implementation Plan
Stat.	—	Statute
USACE	—	US Army Corps of Engineers
USC	—	United States Code
USCG	—	US Coast Guard
USEPA	—	US Environmental Protection Agency
USFS	—	US Forest Service
USFWS	—	US Fish and Wildlife Service

## **3.2 GENERAL HYDRAULIC DESIGN POLICIES**

### **3.2.1 Introduction**

An adequate drainage structure may be defined as one that meets the following policies:

- the design of the structure meets or exceeds standard engineering practice, and
- the design is consistent with what a reasonably competent and prudent hydraulics designer would do under similar circumstances.

The studies listed below are commonly conducted as a part of the design of most highway drainage structures and serve as a means of achieving an adequate drainage design:

- hydrologic analysis,
- hydraulic analysis, and
- engineering evaluation of selected alternatives.

These studies are discussed further in the following sections.

### **3.2.2 Hydrologic Analysis**

Present state-of-practice formulas and models for estimating flood flows are based on statistical analyses of rainfall and runoff records and, therefore, provide statistical estimates of flood flow with varying degrees of error. The recommended practice is for the hydraulics designer to select appropriate hydrologic estimating procedures (see also Chapters 7 “Hydrology” and Chapter 9 “Culverts”), and to obtain runoff data where available for purposes of evaluation, calibration and determination of the predicted value of the desired flood frequencies. Because the predicted value of the flood flow represents the hydraulics designer’s best estimate, there is a chance that the true value of the flow for any flood event will be greater or smaller than the predicted value. The expected magnitude of this variation can be determined for some formulas or models as a part of the hydrologic design procedure.

### **3.2.3 Hydraulic Analysis**

The next step in the design process involves preliminary or trial selections of alternative designs that are judged to meet the site conditions and to accommodate the flood flows selected for analysis. The hydraulic analysis is made utilizing appropriate formulas, physical models or computer programs for purposes of defining, calibrating and checking the performance of the preliminary designs over a range of flows. See Chapter 8 “Channels”, Chapter 9 “Culverts” and Chapter 10 “Stormwater Drainage.”

### **3.2.4 Engineering Evaluation**

The final step in the design process is the engineering evaluation of the trial designs and approval of the selected final design. This process involves consideration and balancing of a number of factors including:

- legal considerations,
- flood hazards to highway users and neighboring property owners,
- costs,
- environmental and social concerns, and
- other site concerns.

### **3.2.5 General Policies**

Hydrologic analysis and hydraulic analysis set forth the design process representative of the present “standard engineering practice.” Engineering evaluation outlines the approach to be followed by a “reasonably competent and prudent hydraulics designer” in evaluating, selecting and approving a final design. The following policies are made for this design process:

- Water may not be diverted from its natural course or discharged onto land or through a water course that would not normally receive such waters without first obtaining the legal right to do so from the affected landowners.
- It is the hydraulics designer’s responsibility to provide an adequate drainage structure. The hydraulics designer is not required to provide a structure that will handle all flood flows under all possible site conditions.
- The detail of design studies should be commensurate with the risk 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” is the smallest recurrence interval flood that will result in flow over the highway. The “design flood” is the recurrence interval of the flood for which the drainage structure is sized to assure that no highway overtopping, no traffic interruption or significant damage would result. The overtopping flood and the design flood may vary widely depending on the grade, alignment and functional classification of the road and the characteristics of the water course and floodplain, see Chapter 7 “Hydrology.”
- The 100-year flood (also called base flood by FEMA) serves as the present engineering standard base flood for evaluating flood hazards and as the basis for regulating floodplains under the National Flood Insurance Program, Federal Emergency Management Agency (FEMA). The hydraulics 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.
- Where a Federal-Aid highway crosses or encroaches on floodplains, the requirements outlined in 23 CFR 650A must be met. These requirements can be summarized as follows:
  - For a Regulatory Floodway, the increase of water elevation (backwater) caused by the 100-year (base) flood must not exceed 1 ft as established by FEMA.



- For a non-Regulatory Floodway, the increase of water elevation (backwater) caused by the 100-year (base) flood must not be more than an amount as determined by risk assessment.
- The floor elevation for a new building (including basement) must be above the 100-year (base) flood elevation.
- The developed hydraulic performance curve of a drainage structure depicts the relationship between floodwater stage (or elevation) and flood flow magnitudes and frequencies. The performance curve should include the 100-year flood. With the performance curve, the hydraulics designer can evaluate the adequacy of the design using the ODOT practices in the design chapters and consider errors of estimate in the hydrologic estimating procedure. It is standard engineering practice to use the predicated value of the 100-year flood as the basis for evaluating flood hazards; however, flows larger than this value may be considered for complex, high risk or unusual cases that require special studies or risk analyses.



### 3.3 FEDERAL POLICY

This section lists significant Federal legislation that presents Federal policies that may affect drainage design and construction. The Section provides the legislative reference, regulation reference, purpose, applicability, general procedures and agency coordination. For more detailed information on specific Federal policy, the applicable legislation should be consulted.

#### 3.3.1 Environmental

1. National Environmental Policy Act: 42 USC 4321-4335 (P.L. 91-190 and 94-83). Reference: 23 CFR 771-772, 40 CFR 1500-1508, 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 FHWA actions.

*General Procedures* — Procedures set forth in CEQ regulations and 23 CFR 771.

*Coordination* — Appropriate Federal, State and local agencies.

2. Economic, Social and Environmental Effects: 23 USC 109(h) (P.L. 91- 605), 23 USC 128, 23 CFR 771-772.

*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; and systematic interdisciplinary approach. The report required by Section 128 on the consideration given to the social, economic and environmental impacts of the project may be part of the NEPA compliance document.

*Coordination* — Appropriate Federal, State and local agencies.

3. Public Hearings: 23 USC 128, 23 CFR 771.111(h).

*Purpose* — To ensure adequate opportunity for public hearing(s) on the effects of alternative project locations and major design features and 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.

### 3.3.2 **Health**

1. *Safe Drinking Water Act*: 42 USC 300F-300J-26 (P.L. 93-523 and 99-339), 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), and (2) actions that may have a significant impact on an aquifer or wellhead protection area that is the sole or principal drinking water source.

*General Procedures* — (1) Compliance with national primary drinking water regulations, (2) compliance with State wellhead protection plans, and (3) compliance with MOAs between USEPA and FHWA covering specific sole-source aquifers.

*Coordination* — USEPA and appropriate State agency.

2. *Solid Waste Disposal Act*: As amended by the *Resource Conservation and Recovery Act* of 1976: 42 USC 6901, et seq., see especially 42 USC 6961-6964 (P.L. 89-272, 91-512 and 94-580), 40 CFR 256-300.

*Purpose* — Provide for the recovery, recycling and environmentally safe disposal of solid wastes.

*Applicability* — All projects that necessitate the disposal of solid wastes.

*General Procedures* — Solid wastes will be disposed of according to the rules for specific waste involved.

*Coordination* — USEPA and appropriate State agency.

### 3.3.3 **Historic and Archeological Preservation**

1. *Section 106 of the National Historic Preservation Act, As Amended*: 16 USC 470F (P.L. 89-665, 91-243, 93-54, 94-422, 94-458, 96-199, 96-244 96-515 and 102-575), 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 projects on subject properties, (2) afford Advisory Council and affected public an early opportunity to comment in accordance with 36 CFR 800, and (3) avoid or mitigate damages to greatest extent possible.

*Coordination* — State Historic Preservation Officer, Advisory Council on Historic Preservation, DOI (NPS), public.

### 3.3.4 **Land and Water Usage**

1. *Wilderness Act*: 16 USC 1131-1136, 36 CFR 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 the Secretary of the Interior or Agriculture, as appropriate.

*Coordination* — Agriculture (USFS), DOI (USFWS, NPS, BLM) and State agencies.

2. *Wild and Scenic Rivers Act*: 16 USC 1271-1287, 36 CFR 297.

*Purpose* — Preserve and protect wild and scenic rivers and immediate environments for benefit of present and future generations.

*Applicability* — All projects that 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 USC 460-4 to -11 (P.L. 88-578).

*Purpose* — Preserve, develop and assure the quality and quantity of outdoor recreational resources for present and future generations.

*Applicability* — All projects that 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 recreational 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 (USFWS), USEPA, USACE, NRCS, State agencies.

5. Intermodal Surface Transportation Efficiency Act of 1991: Wetlands Mitigation Banks: SEC. 1006-1007 (P.L. 102-240, 105 STAT 1914), 23 USC 133(b)(11), 23 CFR 771, 777.

*Purpose* — To mitigate wetlands impacts directly associated with Federally funded projects by participating in wetland mitigation banks, restoration, enhancement and creation of wetlands authorized under the *Water Resources Development Act* and through contributions to Statewide and regional efforts.

*Applicability* — Federally undertaken, financed or assisted construction and improvements or with impacts on wetlands.

*General Procedures* — Evaluate and mitigate impacts on wetlands. Specific finding required in final environmental document.

*Coordination* — DOI (USFWS), USEPA, USACE, NMFS, NRCS, State agencies.

6. Emergency Wetlands Resources Act of 1986: 16 USC 3921, 3931 (P.L. 99-645).

*Purpose* — To promote the conservation of wetlands in the United States to maintain the public benefits they provide.

*Applicability* — All projects that may impact wetlands.

*General Procedures* — (1) Preparation of a National Wetlands Priority Conservation Plan that provides priority with respect to Federal and State acquisition, and (2) provides direction for the National Wetlands Inventory Project.

*Coordination* — USFWS.

7. Rivers and Harbors Act of 1899: 33 USC 401, et seq., as amended and supplemented, 23 CFR Part 650, Subparts D and H, 33 CFR 114-115.

*Purpose* — Protection of navigable waters in the United States.

*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* — USACE, USCG, USEPA, State agencies.

8. *Federal Water Pollution Control Act (1972)*: As amended by the *Clean Water Act (1977 & 1987)*: 33 USC 1251-1376 (P.L. 92-500, 95-217, 100-4), DOT Order 5660.1A, 23 CFR 650, Subpart B, 771, 33 CFR 209, 320-323, 325, 328, 329, 40 CFR 121-125, 129-131, 133, 135-136, 230-231.

*Purpose* — To 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 United States.

*General Procedures* — (1) Obtain permit for dredge or fill material from USACE or State agency, as appropriate (Section 404), (2) NPDES permit and other discharge permits are to be acquired from USEPA or appropriate State agency (Section 402), (3) water quality certification is required from State water resource agency (Section 401), and (4) all projects should be consistent with the State non-point source pollution management program (Section 319).

*Coordination* — USACE, USEPA, 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, 23 CFR 650, Subpart A, 23 CFR 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 that encroach upon or affect the base floodplain.

*General Procedures* — (1) Assessment of flood hazards, and (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 USC 4001-4128, DOT Order 5650.2, 23 CFR 650, Subpart A, 44 CFR 59, 62, 64-68, 70-71, 75-77, 23 CFR 771.

*Purpose* — (1) Identify flood-prone areas and provide insurance, and (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 USC 1301-1311 (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. *Fish and Wildlife Coordination Act*: 16 USC 661-666C (P.L. 85-624, 89-72, 95-616).

*Purpose* — Conservation, maintenance and management of wildlife resources.

*Applicability* — (1) Any project that involves impoundment (surface area of 10 acres or more), diversion, channel deepening or other modification of a stream or other body of water, and (2) transfer of property by Federal agencies to State agencies for wildlife conservation purpose.

*General Procedures* — Coordinate early in project development with USFWS and State fish and wildlife agency.

*Coordination* — DOI (USFWS), State fish and wildlife agencies.



### 3.4 ODOT POLICIES

The policies adopted by ODOT for drainage design can be summarized as follows:

- For Federal-aid projects, the hydraulics designer must follow the design policies as stated in Sections 3.2 and 3.3.
- For non-Federal-aid projects, the hydraulics designer must follow the design policies as stated in Section 3.2. If there are significant differences between ODOT and local policies, an agreement on which design policies apply must be accepted by ODOT and the local officials.
- In general, the *ODOT Roadway Drainage Manual* presents ODOT's detailed design policies for various drainage structures (e.g., culverts, channels, storm drainage).
- To protect ODOT drainage facilities (i.e., bridges, culverts, ditches etc.) from being overloaded by extra runoff from new adjacent developments, ODOT requests that the runoff from these new adjacent developments should be reduced to the existing (historical) runoff level. This request is applied for the 6 major frequencies, including the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return period rainfall. The developers should use detention facility(ies) to achieve this request.
- The design criteria of the detention facility(ies) should be explained in details in Chapter 12– “Storage Facilities.” It could be summarized as follows:
  - Use the NRCS (formerly SCS) Type II or Type III 24-hour duration rainfall distribution in computing the peak discharges and in hydrographs routing (see SCS TR-55). A copy of the distribution with 6 minutes increment should be attached. The use of the hypothetical rainfall distribution hydrograph, the SCS simplified hydrograph and the Modified Rational Method triangular hydrograph are NOT accepted.
  - The Curve Number (CN) of the land should be based on the local soil as shown in the NRCS Soil Report of the related County and also on the proposed land use change.
  - Use 6 major frequencies in the routing, including the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return period rainfall.
  - The use of the US Corps of Engineers (USACE) programs HEC-1 or HEC-HMS in the routing is recommended. Other commercial programs can be used as long as all the ODOT Design Criteria are satisfied.
  - The 24-hour (or the 1-day, whichever is greater) duration rainfall precipitation data of the site should be obtained from the 1999 USGS WRI No. 99-4232 instead of from the 1966 US Weather Bureau TP-40 and NOAA HYDRO-35.

- If the size of the proposed pond is greater than 20 acres, the hydraulics designer should conform with the requirements from the Oklahoma Water Resources Board (OWRB) for the detention pond.
- The size of the principal spillway structure of the proposed detention pond should not be greater than the downstream structure size.

### **3.5 LOCAL POLICIES**

Some major cities (e.g., Tulsa, Lawton, Oklahoma City, Ardmore) have adopted their own design policies and criteria for drainage. These policies may or may not conform to ODOT design policies. As explained in Section 3.4, if there are significant differences between ODOT and the local policies, an agreement on which design policies apply must be accepted by ODOT and the local officials.

