

CHAPTER 4 – DRAINAGE IMPROVEMENTS

4.1 Introduction

Depending on the specific characteristics of a particular watershed, one method to lessen the impacts of flooding is to modify the stream or river channel. Modifying the channel attempts to provide a greater carrying capacity for moving floodwaters away from areas where damage occurs. Methods of drainage improvements include overflow channels, channel straightening, restrictive crossing replacements, and rainfall/runoff storage. Table 4-1 presents a summary of advantages and disadvantages for using drainage improvements as a mitigation measure.



CAUTION

Drainage improvements may help one area but create new problems in another. Whenever drainage improvements are considered as a flood mitigation measure, the effects upstream and downstream from the proposed improvements need to be considered.

Table 4-1. Considerations for Using Drainage Improvement

Advantages	Disadvantages
<ul style="list-style-type: none"> ▪ Can increase a stream’s carrying capacity through overflow channels, channel straightening, restrictive crossing replacements, or rainfall/runoff storage. ▪ Minor projects may be fundable under FEMA mitigation grant programs. 	<ul style="list-style-type: none"> ▪ May help one area but create new problems upstream or downstream of the proposed improvements. ▪ Channel straightening increases the capacity to accumulate and carry sediment, thereby potentially adversely affecting the surrounding areas and the stream system’s equilibrium. ▪ There can be difficulty in setting culverts of a sufficient size in a stream to convey the 100-year flood discharge, unless weir flow over the road surface is considered.

For a detailed discussion of drainage improvements, see FEMA 511, *Reducing Damage from Localized Flooding*, Chapter 8. Additional references are included in Section 4.5, Available Resources.

4.2 Technical Considerations

4.2.1 Depth of Flood

The drainage improvement project is built to a certain flood protection level that may be exceeded by a larger flood event and thereby cause more damage to the structure than might have occurred without the project.

4.2.2 Adverse Impact Downstream

A drainage improvement project, such as a channelized stream, can worsen flooding problems downstream because water is transported at a faster rate. Since the stream now has the capacity to carry more water, it will also have an increased capacity to accumulate and carry sediment. The additional sediment load may come from accelerated bank or stream bottom erosion.

4.3 Relative Costs

The relative cost ranking is based on the combination of the estimated costs for the drainage improvement project and a determination of cost-effectiveness.

4.3.1 Estimated Cost

The cost of a drainage improvement project will vary, depending on materials used and the size and scope of the project. In order to determine the relative cost of a drainage improvement project, examples of cost estimating items that may need to be considered include the following:

- Type of equipment needed for the job, such as the size of backhoe needed to excavate the trench.
- Depending on the depth and width of an excavation trench, shoring might be needed. If shoring is needed, amount of material needed for shoring.
- Removal of excavated material. For example, the estimated quantity and distance from the nearest dump site and if there are fees associated with dumping the excavated material.
- Supplies, such as length of pipe and number and type of pipe fittings needed

Appendix C, Cost Estimating, provides guidance and references for conducting a more detailed cost estimate. Additional cost estimates can be obtained from R.S. Means' *Contractor's Pricing Guide*. A blank preliminary cost estimating worksheet (Worksheet D) is provided in Appendix B, Blank Worksheets.

4.3.2 Determination of Cost-Effectiveness

A component of the relative cost scoring is to include a determination of cost-effectiveness. Table D-1 in Appendix D, Determining Cost-Effectiveness, provides a quick screening for the cost-effectiveness of a project. The attributes included in the table are frequency of flood, level of damage, project cost, project benefits, and criticality (impact or loss of function). For example, if the frequency is the 10-year flood, the project will have a very high likelihood of cost-effectiveness.

Based on the combination of the estimated cost of the project and the likelihood of cost-effectiveness, a relative cost ranking will be assigned on Worksheet B, Appropriate Mitigation Measures. If the likelihood of cost-effectiveness is low, the ranking of relative cost will be either moderate or high, based on the estimated cost of the project. However, if the estimated cost is low and the likelihood of cost-effectiveness is very high or high, the relative cost ranking will be low.

4.4 Additional Considerations

4.4.1 Annual Maintenance

A regular program of drainage system maintenance can detect and resolve problems before they become large obstructions and create flooding themselves. Examples of the work involved in maintaining the drainage system include the following:

- Enacting formal procedures to maintaining the public drainage system, the Community Rating System (CRS) provides credit for enacting these procedures (see text box at right);
- Involving citizens in the maintenance process through organized “stream teams” or by training homeowner associations;
- Enacting regulations against dumping; and
- Informing the public about the importance of yard maintenance, keeping the drainage system free of obstructions, and notifying public officials about problems.

Through Activity 540 (Drainage System Maintenance), the CRS encourages and provides credit for the following:

- A formal program that inspects the drainage system, removes debris and corrects drainage problem sites
- Stream dumping regulations
- A capital improvements plan to eliminate or correct problem sites

4.5 Available Resources

ASFPM. *No Adverse Impact: A Toolkit for Common Sense Floodplain Management*.
http://www.floods.org/NoAdverseImpact/NAI_Toolkit_2003.pdf

FEMA. *Promoting Mitigation in Louisiana: Performance Analysis*.
<http://www.fema.gov/pdf/casestudys/performance.pdf>

FEMA NFIP/CRS. *CRS Credit for Drainage System Maintenance*.
<http://www.training.fema.gov/emiweb/CRS/m7s5main.htm>

FEMA 511. *Reducing Damage from Localized Flooding*. See Chapter 8, Drainage Improvements.

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