

# CHAPTER 890 – STORM WATER MANAGEMENT

## Topic 891 – General

### Index 891.1 – Introduction

The term “storm water management” refers to the cooperative efforts of public agencies and the private sector to mitigate, abate, or reverse the adverse results, both in water quantity and water quality, associated with the altered runoff phenomena that typically accompanies urbanization. Storm water management encompasses a number of control measures, which may be either structural or non-structural (including policy and procedural measures) in nature.

This chapter will focus primarily on the management of storm water runoff quantity. Information related to the designer’s responsibility for the management of storm water runoff quality is contained in the Department’s Project Planning and Design Guide.

### 891.2 Philosophy

When runoff impacts result from a Department project, then the cost of mitigating these impacts is a legitimate part of the project cost. Since transportation funds are increasingly limited, and because mitigation of runoff problems can be expensive, it is important to identify the causative factors and responsible parties. When runoff impacts are caused by others, avenues for assigning these costs to the responsible party should be evaluated. The local agencies responsible for land use in the area are a good place to begin this evaluation, as many of these local agencies have enacted land use regulations in an effort to control flooding. These regulations often require that developers limit changes in the volume and rate of discharge between the pre- and post-development site conditions. In addition, many local agencies must be responsive to their own storm water permits which require that they implement programs to control the quality of storm water discharges within their jurisdiction. When runoff impacts are caused jointly by the Department and others, it may be possible to develop cooperative agreements allowing joint impact mitigation. See Indexes 803.2 and 803.3 for further discussion on cooperative agreements and up-grading of existing highway drainage facilities.

## Topic 892 – Storm Water Management Strategies

### 892.1 General

*Quantity / Quality Relationship.* Management of storm water quality often requires the assessment of relatively small runoff producing events. As much as 80 percent of average

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annual rainfall is produced by storms with return periods of less than 2 years. As a result, water quality facilities are typically sized to address relatively small runoff volumes. Conversely, storm water quantity management is typically directed at reducing the peak flow rate on storms with a 10-year or greater return period, and water quantity control facilities must be sized accordingly.

In order to achieve both water quantity and quality benefits, it may be necessary to use a combination of strategies or control measures. For example, placement of a relatively small detention basin or filtration immediately upstream of a quantity attenuating detention basin can provide sediment capture, while allowing larger flows to be mitigated by the major basin. Some types of water quality control measures will need to incorporate bypass features so that the smaller, more frequent, runoff events can be treated while still allowing larger flows to be routed away from the traveled way.

## 892.2 Types of Strategies

There are various storm water management strategies which may be used to mitigate the effects of storm water runoff problems. They vary from very simple to very complex techniques depending upon specific site conditions and regulatory requirements which must be satisfied.

The Department Storm Water Quality Handbook, "Planning and Design Staff Guide" provides both design guidance on specific water quality control measures as well as a more general discussion of how and when to incorporate water quality control measures into projects.

In addition to the measures described in the Storm Water Quality Handbook, the following measures may provide relief in dealing with the water quantity side of storm water management.

- (1) *Detention & Retention Basins.* The detention and retention basin designs provided in the Storm Water Quality Handbook are based upon water quality control, not quantity control. Refer to the Department training course manual "Storm Water Management Design" for information related to design considerations for peak flood reduction through the use of detention and retention basins. Also, refer to HEC No.22, Chapter 8.
- (2) *Groundwater Recharge.* In some locations highly permeable underground strata may allow percolation of excess runoff into the ground. Benefits include recharge of underground aquifers and the possible reduction or elimination of conveyance systems along with pollutant removal. Special care must be exercised in areas of high groundwater to avoid potential contamination of the aquifer.
- (3) *Drainage Easements.* In areas where right of way is inexpensive it may be possible to purchase flood easements. These areas are typically used for agriculture and are subject to flooding at any time during specified times of the year. Cooperative agreements with local agencies or flood control districts will typically be necessary.

### 892.3 Design Considerations

The items presented below describe some of the issues to be considered prior to, and during, the design of any storm water management facility. General issues common to most storm water management strategies that need to be evaluated are:

- Access for maintenance must be provided, and the facility must be maintainable. Storm water control facilities must not become regarded as wetlands themselves, which would require special permits for routine maintenance.
- Facilities should be designed to “blend in” with their surroundings to the greatest extent possible. The district landscape architecture unit should be contacted for assistance.
- The effects of the proposed facility on channel capacities and existing floodways require evaluation. Care must be taken to evaluate the effects related to the delayed release from detention facilities since an increase in downstream peak discharges may result (see Figure 892.3).
- The effects of releasing sediment free “hungry” water into channels and the potential for increased erosion rates downstream must be determined.
- Evaluate the effects of depriving downstream water users (human, aquatic or vegetative) of runoff due to retention, percolation or other diversion.

Storm water management techniques involving on-site and off-site storage may offer the highway design engineer the more reasonable and responsive solution to problems relative to the handling of excess runoff. The cooperation of other jurisdictions is generally a prerequisite to applying these strategies and a cooperative agreement is almost always necessary. See Chapter 12 of the AASHTO Model Drainage Manual for additional design criteria for storage facilities.

### 892.4 Mixing with Other Waste Streams

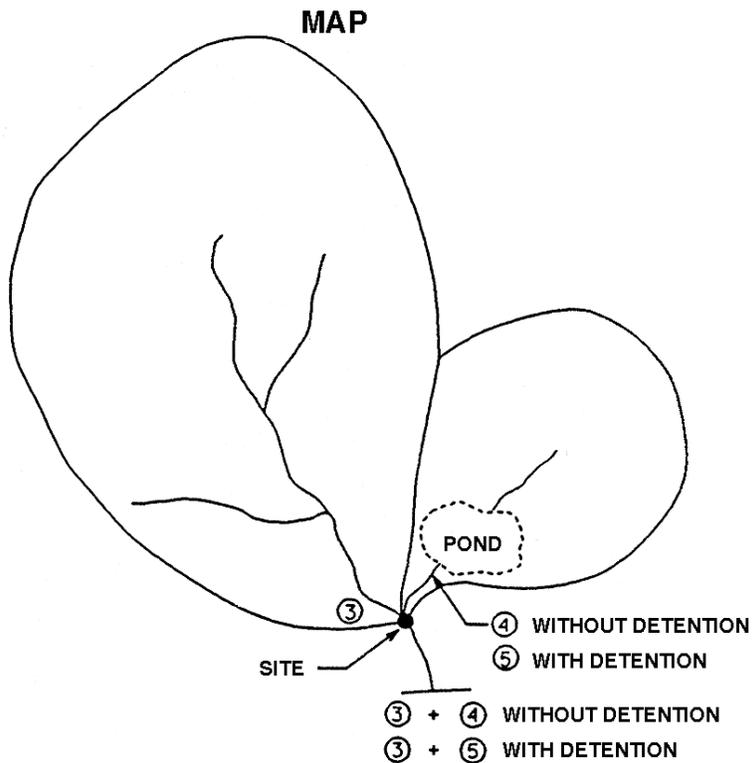
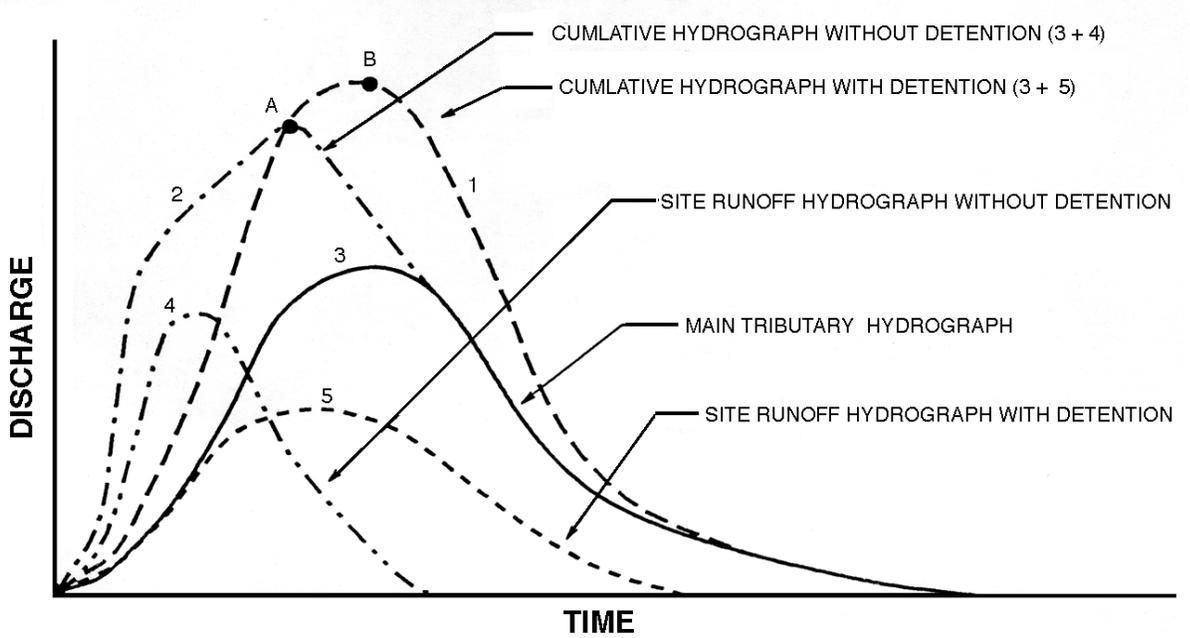
Storm water runoff from State highways will usually be carried to a receiving body of water without being combined with waste water. Although some combined storm and sanitary sewers do exist, their use should be avoided.

The most common areas of waste stream mixing have been at maintenance stations. These facilities may have combined storm water and wash rack systems. Because of wash water and rinse water, maintenance stations present unique water quality problems from concentrated levels of pollutant loadings. The preferable design has a separate system for the wash rack so that it is not mixed with storm water and rinse water. For additional advice on treatment of concentrated waste streams at maintenance stations, contact the Water/Waste Water Unit in the Division of Engineering Services – Structures Design.

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Figure 892.3

Example of Cumulative Hydrograph With and Without Detention



## Topic 893 – Maintenance Requirements for Storm Water Management Features

### 893.1 General

As mentioned previously, the ability and the commitment to maintain storm water management facilities is necessary for their proper operation. The designer must consider the maintenance needs, and the type of maintenance that will take place, in order to provide for adequate access to and within the facility site.

Additionally, the designer should initiate both verbal and written contact with District maintenance to verify the availability of resources to provide proper maintenance and to keep them aware of potential high maintenance items that will be constructed. Initial estimates of how often sediment removal should be performed should be provided by the designer based upon estimated design loadings. Other types of maintenance, such as periodic inspections of embankments, inlet/outlet structures, debris removal, etc. should also be discussed. Due to the large capital investment required for constructing storm water management facilities, proper maintenance cannot be overlooked.

By definition, detained water contributes to runoff and therefore detention ponds or basins must have an outlet and outfall system (see Index 816.4). A gravity outfall should be used whenever feasible. Pumping should only be used where there is no other practical way of handling the excess runoff. See Topic 839 for further discussion on pumping stations.