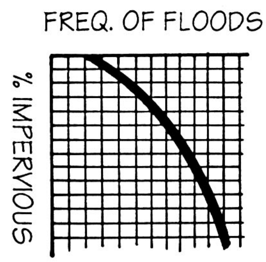
Environmental Indicator Profile Sheet



Indicator Profile No. 10

Increased Flooding Frequency

Category: **Physical and Hydrological**

Tools Used to Measure Indicator:

- Stream gaging data
- Computer modeling
- Stream channel obstruction assessments

Description:

Flooding frequency (or flowrate magnitude change) is measured over time to determine the response to changing levels of urbanization. The number and magnitude of flooding events (in response to rainfall or snowmelt) for a particular location or specific stream segment is documented and compared with the relative changes in land use. Another method is to compare peak flows for different frequency events in urban watersheds and in rural watersheds with similar physiographic characteristics.

The amount of debris and obstructions identified and documented for a given stream reach also provides an indirect measure of flooding potential. Obstructions are identified through stream channel reconnaissance assessments.

The frequency of bankful storm events (in streams) and the corresponding amount of rainfall are essential in understanding stormwater impacts and planning restoration efforts.

Utility of Indicator to Assess Stormwater Impacts:

- Can be used to assess the frequency, duration, and quantity of flooding with increasing urbanization.
- Can be used to evaluate the effectiveness of structural BMPs in reducing flooding and streambank erosion potential.
- Can be used to evaluate flooding potential associated with different land use development patterns.
- Can help identify specific flood prone areas.
- Can indirectly predict potential for streambank erosion and habitat degradation.
- Frequently identified debris and obstructions can be an indicator of increased flooding potential which can underline the need for corrective actions.

Indicator Useful for Assessing:

* Aquatic Integrity of:	
Lakes	○
Streams	●
Estuaries	○
* Land Use Impacts	●
* Stormwater Mgmt Programs	●
* Whole Watershed Quality	◖
* Industrial Sites	◖
* Municipal Programs	●

Key:	
Very Useful	●
Mod. Useful	◖
Not Useful	○

Indicator Advantages

* Geographic Range	●
* Baseline Control	◖
* Reliable	●
* Accuracy	◖
* Low cost	◖
* Repeatable	◖
* All Watershed Scale	●
* Familiar to Practitioners	●
* Easy to use & Low training	◖

Key	
Very Advantageous	●
Mod. Advantageous	◖
Not Advantageous	○

Cost

See Table 3.3B

Advantages of Method:

- Flooding is a well-known occurrence and is understood by the general public. Corrective measures are more readily addressed than less tangible water quality issues.
- Increased flooding is fairly easily documented and can be reasonably accurately modeled using several computer models.
- Can help focus public attention and support for urban stormwater programs. Can act as a catalyst in developing other watershed restoration initiatives.

Disadvantages of Method:

- May focus too much attention on structural solutions (such as levees, flood control channels, etc.) rather than more natural, biologically based alternatives.
- Increased flooding frequency may encourage jurisdictions to institute more stringent onsite stormwater regulations without evaluating the hydrologic/hydraulic implications within the watershed.
- Does not provide any data on changes in water quality.

Case Study: Weiss, L.A., 1990
Effects of Urbanization on Peak Streamflows in Four Connecticut Communities, 1980-84
USGS Water-Resources Investigations Report 89-4167

Peak stormwater flows for six urban streams in Connecticut were determined from rainfall and runoff data collected from 1981 to 1984 and from a computer rainfall-runoff model that simulated storm runoff for a period from 1951 to 1980. Recurrence intervals for these six streams and three other urban streams were estimated using the log-Pearson Type III method. These results were compared with peak flows for rural streams that were computed from regression equations.

Ratios of peak flows in urban basins to peak flows in rural basins are about 1.5 to 6.1 for the 2 year frequency event and 1.1 to 4.3 for the 100 year frequency event. The lower ratios, for each case, apply to areas where 30% of the basin is served by storm sewers. The higher ratios apply to areas where 90% of the basin is served by storm sewers.

Method References:

- Stream gaging data: Bailey, J.F.; W.O. Thomas, K.L. Wetzel, T.J. Ross, 1989. Estimation of Flood-Frequency Characteristics and the Effects of Urbanization for Streams in the Philadelphia, Pennsylvania Area., In: *USGS Water-Resources Investigations* Report 87-4194, March 1989. 71p.

- Computer modeling: Richter, K.G.; G.A. Schultz, 1988. Aggravation of Flood Conditions Due to Increased Industrialization and Urbanization., In: *Hydrological Processes and Water Management in Urban Areas.* Proceedings of the International Symposium 24-29 April 1988, Duisburg, West Germany.

- Change in Flood Peaks: Kibler, D.F.; D.C. Froelich; G. Aron, 1981. Analyzing Urbanization Impacts on Pennsylvania Flood Peaks., In: *Water Resources Bulletin,* American Water Resources Association. Vol. 17, No. 2, April 1981.