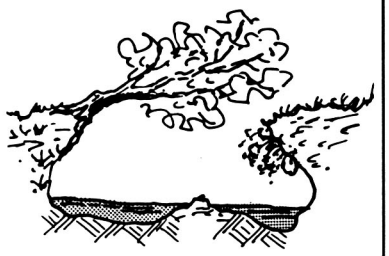
Environmental Indicator Profile Sheet



Indicator Profile No. 7

Stream Widening/Downcutting

Category: **Physical and Hydrological**

Tools Used to Measure Indicator:

- Stream cross-sectional geometry measurements
- Prevalence of stream bank erosion
- Sediment embeddedness

Description:

The change in stream geometry is measured over time to determine the extent of channel widening/downcutting in response to changes in the magnitude and frequency of stormflows. Stream channel and bank erosion can be documented by measuring channel cross-sections at monumented locations, by measuring channel bankfull width and depth of representative reaches or by measuring the percent of channel-bank scour within specified channel reach lengths. Measurements should be conducted over a period of time in response to upstream land use changes.

Utility of Indicator to Assess Stormwater Impacts:

- Can be used to help document stream segments which are susceptible to channel erosion (by comparison to other stream systems with similar channel slopes and geologic materials).
- Can help provide documentation regarding the rate of stream channel erosion as a function of increased urbanization.
- Can be useful to estimate BMP quantity effectiveness, and in documenting locations where additional controls are needed to protect the stream.
- Can be useful in estimating habitat quality and therefore provide information regarding whether water quality or excessive flow discharges are limiting factors in a stream with respect to overall aquatic health.
- Can help a municipality develop better storm event management criteria to reduce streambank erosion.

Advantages of Method:

- Reasonably easy to measure. Requires little specialized equipment and only minor training.
- Can provide similar results regardless of the experience or preferences of the investigator, very repeatable.
- Inexpensive and conducive to rapid assessment techniques.
- Valuable in assessing impacts over time as a result of upstream land use changes.
- Can help relate post-development changes in stream hydrology to changes in stream habitat.

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

Disadvantages of Method:

- Many stream networks may have already been substantially modified by channelization or storm drain enclosure.
- May not accurately assess aquatic habitat impacts in the absence of stream channel erosion.
- Is not by itself a predictive indicator. Once stream widening and downcutting are observed, degradation associated with upstream land uses is already occurring. The absence of erosive conditions may lead to false conclusions regarding future disturbances.
- May not adequately evaluate current land use impacts where past erosion and sedimentation has modified natural stream morphological processes (e.g., in urbanizing areas with past intensive agricultural land uses).
- May not be applicable for larger streams and rivers.

Case Study: Krug, W.R.; G.L. Goddard, 1986
Effect of Urbanization on Streamflow, Sediment Loads, and Channel Morphology in Pheasant Branch Basin Near Middleton, Wisconsin
USGS Water-Resources Investigations Report 85-4068

A five year monitoring and modeling study was conducted on Pheasant Branch basin near Middleton, WI. The study analyzed the effects of urbanization on streamflow characteristics, sediment loads and channel morphology and took steps to predict the future effects associated with urbanization. The results of the study showed significant increases in sedimentation downstream from highly urbanized areas. Stream beds were lowered an average of two feet and significant stream widening occurred over the five year period downstream from the fully urbanized portion of the basin. Storm runoff modeling of full urban buildout revealed that simulated mean annual flood peaks would increase by more than a factor of 2 and stream widening would increase another 40 to 50% over current conditions.

Method References:

- Stream cross-sectional area measurements: Booth, D.B. 1994. *A Protocol for Rapid Channel Assessment*, Unpublished Report, Available from King County, Washington, Surface Water Management Division, Water Resources Section.

- Prevalence of stream bank erosion: MacRae, C.R.; A.C. Rowney, 1992. The Role of Moderate Flow Events and Bank Structure in the Determination of Channel Response to Urbanization. In: *Proceedings: Canadian Water Resources Association, Kingston, Ontario., 45th Annual Conference Resolving Conflict and Uncertainty in Water Management, June 1992.*

- Sediment embeddedness: Plafkin, J.L.; M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes, 1989. *Rapid Bioassessment Protocols for use in Streams and Rivers Benthic Macroinvertebrates and Fish.* Report No. EPA/440/4-89/001.