Impervious Cover

Impervious cover is any impervious surface in the landscape that cannot effectively absorb and infiltrate rainfall. For the purpose of this Manual, impervious surfaces include, but are not limited to roads, parking lots, driveways, roofs, sidewalks, patios (i.e., solid or open-joint patios or decks with an underlying impervious surface), water surfaces of manmade impoundments (i.e., stormwater ponds and swimming pools) only if they are hydraulically connected to a storm drainage system, receiving waterbody, or wetland; compacted gravel surfaces and highly compacted soils. These surfaces disrupt the natural hydrologic cycle, increasing surface runoff and decreasing infiltration of rainfall into the soil.

Impervious cover is widely considered a key environmental indicator. A large body of scientific literature has shown that groundwater recharge, stream base flow, and water quality measurably change and can decrease as impervious cover increases. Studies have shown a direct relationship between the intensity of development, as indicated by the amount of impervious cover, and the degree of damage in a watershed. [32, 33, 34, 35, 36, 37, 38] Research nationwide has shown that when impervious cover in a watershed reaches approximately 10 percent, ecological stress becomes clearly apparent. Beyond 25 percent, stream stability is reduced, habitat is lost, water quality becomes degraded, and biological diversity decreases.[39] Figure 2-3 illustrates this effect.

Studies indicate that as the amount of impervious cover in a watershed exceeds 12 percent, unacceptable impacts to aquatic life can be predicted to occur in surface waters. The Connecticut Watershed Response Plan for Impervious Cover set a target of 11 percent impervious cover or less to be applied in Connecticut based on the observed water quality

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[32] Schueler T. R. Kumble P. A. Heraty M. A. Metropolitan Washington Council of Governments & United States. (1992). A current assessment of urban best management practices: techniques for reducing non-point source pollution in the coastal zone. Metropolitan Washington Council of Governments.

[33] Schueler, T.R. 1994. “The Importance of Imperviousness”. Watershed Protection Techniques. Vol. 1, No. 3.

[34] Schueler, T.R. 1995. Site Planning for Urban Stream Protection. Metropolitan Washington Council of Governments. Washington, D.C.

[35] Booth, D.B. and L.E. Reinelt. 1993. “Consequences of Urbanization on Aquatic Systems - Measured Effects, Degradation Thresholds, and Corrective Strategies”, in Proceedings of the Watershed ‘93 Conference. Alexandria, Virginia.

[36] Arnold, C.L., Jr., and C.J. Gibbons. 1996. “Impervious Surface Coverage: The Emergence of a Key Environmental Indicator”. Journal of the American Planning Association. Vol. 62, No. 2.

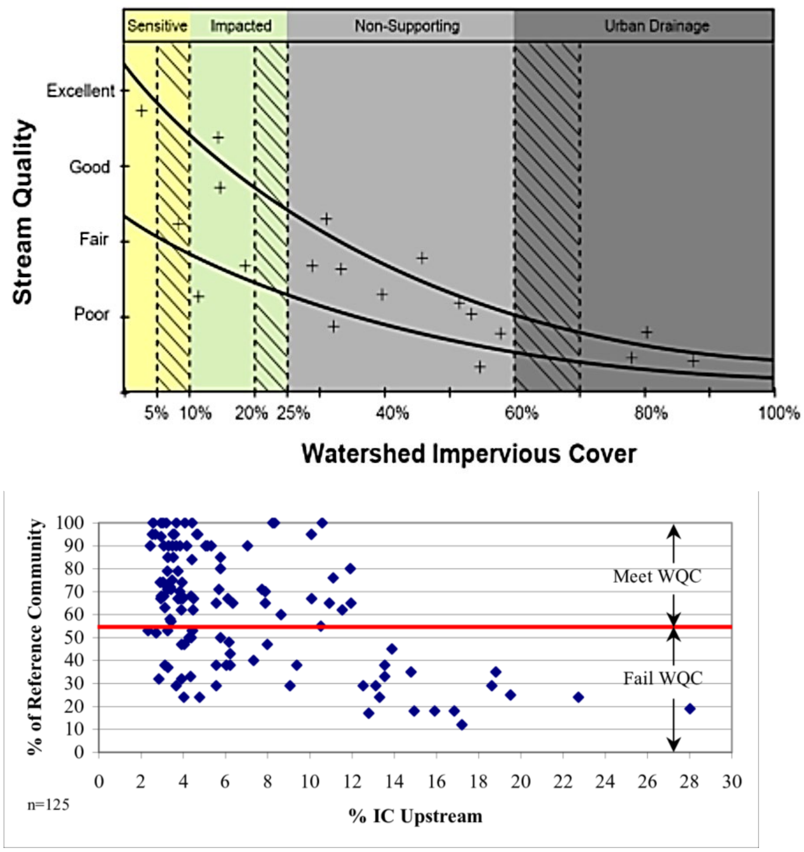
[37] Brant, T.R. 1999. “Community Perceptions of Water Quality and Management Measures in the Naamans Creek Watershed”. Master’s Thesis for the Degree of Master of Marine Policy

[38] Shaver, E.J. and J.R. Maxted. 1996. “Technical Note 72 Habitat and Biological Monitoring Reveals Headwater Stream Impairment in Delaware’s Piedmont”. Watershed Protection Techniques. Vol. 2, No. 2.

[39] Natural Resources Defense Council (NRDC). 1999. Stormwater Strategies: Community Responses to Runoff Pollution.

impairments at 12 percent IC and an application of a 1 percent margin of safety. Stormwater runoff has been identified as a probable contributing cause to the impairment. Municipalities and other stakeholders should therefore aim to mitigate stormwater impacts in areas with IC greater than 11 percent to reduce the amount of stormwater pollution reaching surface waters, to improve water quality.

Figure 2-3. Relationship Between Watershed Impervious Cover and Stream Health



National impervious cover model (top) and scatterplot of percent impervious cover and reference macroinvertebrate communities in Connecticut (bottom).

Image sources: Center for Watershed Protection[40] (top) and Chris Bellucci/CT DEEP (bottom).

[40] Center for Watershed Protection. 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. March 2003.

Impervious Area and Directly Connected Impervious Area

Impervious area (IA) includes any impervious surface in a drainage area or watershed. Impervious area with a direct hydraulic connection to a storm drainage system or a waterbody via continuous paved surfaces, gutters, drainpipes, or other conventional conveyance and detention structures that do not reduce runoff volume is referred to as “Effective Impervious Area” or, for this manual, “Directly Connected Impervious Area (DCIA)”. DCIA is considered a better predictor of watershed/ecosystem health than IA because it only includes impervious surfaces that contribute stormwater runoff to a stream, other waterbody, or wetland.

Impervious areas that are not directly connected to a storm drainage system, receiving waterbody, or wetland are considered “disconnected” and therefore not considered DCIA. The following types of impervious areas are considered disconnected:

- Impervious areas that drain as sheet flow onto and over an adjacent pervious area that, due to its size, slope, vegetation, and underlying soil characteristics, can retain the appropriate portion of the Water Quality Volume, as defined in Chapter 4. This non-structural LID site planning and design technique is called “simple disconnection,” which is described further in Chapter 5 – Low Impact Development Site Planning and Design Strategies.

- Impervious areas that discharge runoff through structural stormwater BMPs designed to retain the appropriate portion of the Water Quality Volume.

- Isolated impervious areas that are not hydraulically connected to a storm drainage system, receiving waterbody, or wetland.

- Swimming pools or man-made impoundments, unless hydraulically connected to a storm drainage system, receiving waterbody, or wetland.

- The surface area of natural waterbodies (e.g., wetlands, ponds, lakes, streams, rivers).

The CT DEEP MS4 General Permit requires regulated municipalities to track and disconnect DCIA using simple disconnection and structural stormwater BMPs for redevelopment projects and retrofits, or by converting impervious surfaces to pervious surfaces. The existing DCIA of a site is also an important factor in determining the portion of the Water Quality Volume that must be retained, also referred to as the “Required Retention Volume” (see Chapter 4).