Low-Impact Development:
A Briefing Paper for the Envision Skagit 2060 Citizen Committee

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What is Low-Impact Development?

Low-Impact Development (widely known by its acronym, LID) is a broad term that covers a wide variety of actions to reduce the impacts of development on stormwater runoff—the quantity and quality of stormwater that flows off of a site toward downstream waterbodies and properties.[1] Examples of LID techniques include, but are not limited to, green roofs, rain gardens, and permeable pavement, as well as broader considerations of site design, such as retaining native trees and soils and locating buildings where they will minimize runoff. These techniques share a common philosophy of trying to mimic or retain natural ways of reducing, detaining, and filtering stormwater runoff on a developed site.

LID techniques have not been mandated by stormwater regulations in the past, but under state regulations that are currently being finalized this will change in coming years. Traditional stormwater management has used pipes and ponds to try to reduce the maximum stormwater flow from a site to limit downstream flooding and to reduce the discharge of pollutants. LID helps address a much broader range of concerns about how land clearing and development affect downstream resources, including low flows, the frequency of flooding, and the total volume of water leaving a site. It also can be much more effective at reducing the discharge of pollutants. But the feasibility and effectiveness of different LID techniques can vary by site.

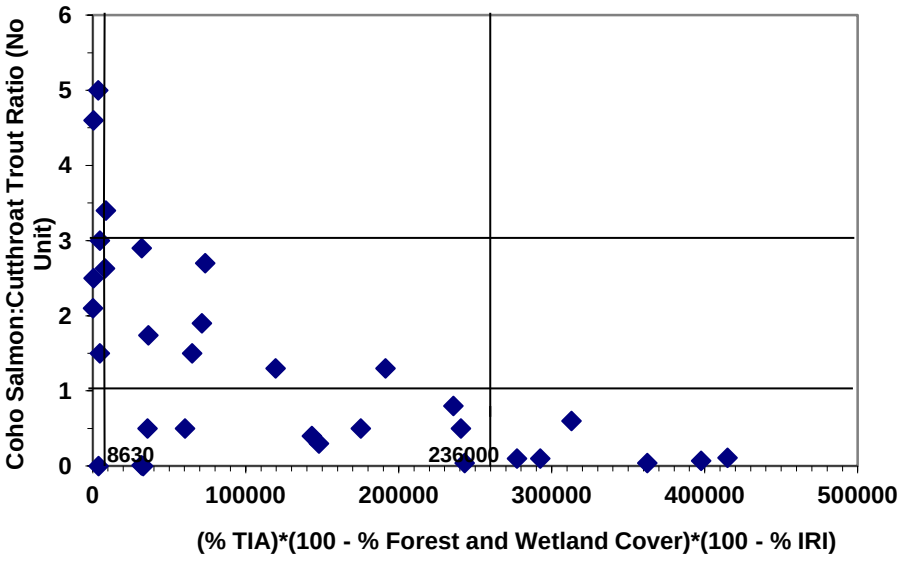
Why the concern with stormwater?

Before development, the natural land cover of most of the Puget Sound region is forest. Typically, our forests intercept about half of all rainfall before it ever moves toward streams—either evaporating water before it reaches the ground or transpiring it after soaking it in through roots or foliage. In addition, over thousands of years the soils in our forests have developed a large, spongy layer of "duff" that soaks up rainwater and releases it very slowly, mostly into aquifers or sub-surface flows. Under all but the largest of storms, there is virtually no surface runoff from native forests. This led local streams, and the salmon and other native creatures that live in them, to adapt to a fairly stable flow environment. Big floods would occur, but they were rare and would create new habitats even as they destroyed old ones.

Big rivers, where flows are dominated by snowmelt, are a different story. The effects of flooding on river habitats relate to the whole floodplain and how it is managed. Stormwater effects from development are of greatest concern for smaller streams. They have dramatic impacts on coho salmon, which rear in small streams for at least a year before migrating to sea. Coho tend to drop in number significantly after even fairly small changes in land cover from forest to impervious—i.e., less than 10% of a stream basin (see chart, next page).

[1] LEED (Leadership in Energy and Environmental Design) standards are broader-based than LID, taking into account energy efficiency, indoor air quality, water consumption, the materials used for construction, support for alternative transportation and many other factors beside stormwater. A development could be LEED-certified without using LID, or could use LID without qualifying for LEED certification.

In addition to effects on flows and physical habitat, stormwater also delivers large quantities of pollutants into local streams. The great majority of pollution entering Puget Sound is from stormwater. This pollution is mostly "non-point"—i.e., it comes from a large number of diffuse sources, such as oil



The chart to the left shows the ratio of coho salmon to cutthroat trout vs an index of development across a range of Puget Sound-area streams. While a variety of factors explain the wide range of results at particular levels of development, the best results for coho were only possible at relatively low levels of development. Source: Horner et al (2002).[2]

leaks or copper brake pads from cars, fertilizers and pesticides from yards or farms, and bacterial pollution from livestock, failing septic systems, pet waste, and other sources. Stormwater pollution is difficult to treat. Generally, the most effective strategy to reduce it is at the source, but this can be an enormous challenge, with so many activities and so many people contributing to it. LID reduces polluted runoff through plants and soils but also by reducing runoff itself. Stormwater that does not leave a site cannot pollute downstream resources.

In Skagit County, farmers are often greatly concerned about stormwater because it contributes to drainage problems on their fields. The water table is naturally high across much of the Skagit Delta, and Delta soils tend to drain slowly. Stormwater from surrounding development can damage crops or delay planting. The farmers' concern relates to the total volume of stormwater at least as much as to peak flows. Traditional stormwater management does little to address total volume, which is increased when forest cover and native soils are removed. By emphasizing retention of forest cover and soils and infiltration of stormwater into the ground, LID addresses concerns about the volume of stormwater much better than traditional practices but cannot solve them completely. When developed surfaces replace forest cover, the water that would have been evaporated or transpired must go somewhere.

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[2] Horner, R., C. May, E. Livingston, D. Blaha, M. Scoggins, J. Tims, and J. Maxted. 2002. Structural and Non-structural Best Management Practices (BMPs) for Protecting Streams. *In* B.K. Urbonas (ed.), *Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation*, American Society of Civil Engineers, New York, pp. 60-77. [Note: Left and right vertical lines in the chart indicate maximum Total Impervious Area associated with relatively high biological integrity and minimum Total Impervious Area associated with relatively low biological integrity, respectively. Numbers near the vertical lines are horizontal axis-intercepts.]

Practical Considerations

LID is often thought of as a solution for urban stormwater, but many of its recommendations for infiltration require larger lots, where greater amounts of vegetation can be retained and there is more flexibility where development is located. Highly urbanized areas can pose challenges for infiltrating large volumes of stormwater, which can risk destabilizing slopes or flooding basements or foundations. In contrast, rural sites that minimize impervious surface and that direct runoff into large, protected forested areas may need few other LID techniques to achieve virtually zero stormwater discharge.

While it is sometimes said that the extent of glacial till limits the feasibility of LID, it is arguably in areas of glacial till where LID techniques can be most valuable. Where soils are highly permeable, most LID techniques are not needed to infiltrate stormwater. Where underlying soils are impermeable, the natural surface layer of duff provides maximum value in reducing stormwater runoff. Techniques that retain or mimic this function therefore also provide maximum value.

While LID techniques can be more expensive than traditional stormwater management, under the right circumstances (especially when taking operation and maintenance expenses into account), they also can be less expensive. Comparisons depend on site and market conditions. Studies monitoring LID projects for the quantity and quality of stormwater runoff have generally been very positive. LID projects can, however, be overwhelmed by the largest storms. Therefore, rather than entirely replacing traditional pipes and ponds, they sometimes may simply reduce the size of the traditional facilities, which may still be needed to minimize downstream flooding.

In 2009, a state appeals board ordered the Washington Department of Ecology to begin working with Skagit County and other "Phase II" Western Washington jurisdictions[3] to prepare for requiring LID techniques "where feasible," to meet requirements in the Clean Water Act to use the best available technology to protect water quality. A long process followed this and an earlier appeals board decision that affected "Phase I" jurisdictions[3] to determine how best to implement this order. Many parties have been concerned that LID techniques will be required without sufficient regard for site differences or cost-effectiveness. The Department of Ecology will issue preliminary draft language for LID requirements for public comment in May 2011.

When the requirements are final, they will be included in permits to be issued to Skagit County and other local Phase II governments in mid-2012. The permits will include timetables for incorporating LID requirements into local codes. This may allow a few years, since the requirements will involve zoning and subdivision codes, road standards, clearing and grading regulations, and other regulations not traditionally considered part of stormwater requirements. However, under a condition of Skagit County's existing permit, it has already evaluated these sections of its code for potential amendment.

Potential Citizen Committee Recommendation

Given the complexity and controversy surrounding LID, the lack of time for the Citizen Committee to study the issue in depth, and the fact that at least some LID techniques will likely be mandated in Skagit County within a few years regardless, if the Committee wishes to discuss LID in its recommendations, it might choose to say something like the following:

[3] Phase I jurisdictions include King County, Seattle, and other local governments with more than 100,000 people (for counties, the number is based on the population of unincorporated areas). Phase II jurisdictions include Anacortes, Burlington, Mount Vernon, and Sedro Woolley but none of the smaller towns in Skagit County.

Support Low-Impact Development

The Citizen Committee supports expanded voluntary use of Low-Impact Development (LID) techniques in public and private projects, especially in sensitive stream basins and where downstream agriculture would likely benefit. The Committee also supports early amendment of local codes to encourage or require LID where feasible, giving special attention to these same places.