Submission to the House of Representatives Standing Committee on Environment and Heritage
Inquiry into Sustainable Cities 2025

By Christopher J. Walsh

This submission relates to the actual current, and potentially much reduced, impact of Australian cities on running waters (and their subsequent impact on downstream waters such as lakes, estuaries and coastal waters). It draws on recent research conducted by the CRC for Freshwater Ecology on the impacts of urbanization on stream ecology in Melbourne.

In this submission, I strongly endorse the need for integrated, sustainable water and stormwater management, but draw the committee's attention to potential pitfalls in some of the approaches that may be canvassed to meet this aim. My focus is on ensuring that waterways and receiving waters of cities achieve as high a degree of ecological condition as is possible.

Streams flowing out of cities are arguably the most sensitive indicators for assessing a city's sustainablity. Sitting at the bottom of the catchment, their ecological condition is a reflection of what goes on up in the catchment. A stream that cannot support the diverse collection of animals and plants typical of undegraded streams and that carries large quantities of pollutants is a sure sign of unsustainable land use in its catchment.

Streams draining the metropolitan areas of all Australian major cities are currently, almost without exception, in very poor condition. The pollutants carried by these streams, particularly after storms, have substantial ecological impacts on waters downstream, potentially threatening to irreversible damage such major environmental assets as Port Phillip Bay[1].

The major cause of this serious degradation of our cities' streams is the way we have traditionally dealt with stormwater when we construct our cities and our suburbs. Stormwater falling on our roofs, paths and roads has, and in most parts of Australia continues to be, managed by draining it as quickly as possible through pipes to the nearest waterway or water body. This practice impacts on streams in two vital ways:

1. The increased frequency and intensity of high flows resulting from catchment urbanization is undoubtedly a degrading factor for receiving streams, particularly as these high flows are associated with poor water quality. The total volume of water and its associated loads of pollutants is also a degrading factor for receiving lakes, estuaries and coastal waters.
2. Although this urban-derived volume of 'problem' water might be seen as a resource ripe for exploitation, it should be recognised that this increased volume is generated at the expense of the health of small streams that once flowed in the now-urbanised catchments, but now act more as near-ephemeral drains. Increased

[1] Harris, G., et al., *Port Phillip Bay Environmental Study Final Report*. 1996, Canberra: CSIRO. 239pp.

surface runoff results in reduced infiltration into sub-surface flow paths that are responsible for the maintenance of baseflows (and serve to reduce pollutant concentrations and loads). The result is a large reduction in baseflows in streams draining urbanized catchments.

Therefore, urban stormwater management could be considered an environmental flows issue. The discussion paper states that discharge of stormwater in the traditional way 'represents a waste of what might otherwise be a valuable water resource'. This statement should not be interpreted as an endorsement of the exploitation of all storm runoff (such that it perpetuates the often stated fallacy that large quantities of water flowing down a river to the sea are a waste of a precious resource). *Uses of stormwater runoff that export water from the catchment (e.g. through the sewerage system) will contribute to the continued degradation of waterways in urban areas.*

The ideal goals for stormwater management should be to retain pre-development (a) runoff volume, (b) runoff frequency-intensity relationships, (c) evapotranspiration, (d) infiltration, (e) baseflow volume and temporal distribution, (f) groundwater storages and depths.

An initial strategy to achieve these goals should be to reduce or minimize the area of impervious surfaces in a catchment. Therefore the provision of greenspaces in urban areas will have an ecological benefit to receiving streams. Some research from the United States[2] suggests that priority areas for such greenspace are headwaters, and around wetlands and streams. However, CRC FE research in Melbourne[3], and US long-term ecological research in Baltimore[4] suggest that the beneficial effects to streams of greenspace are reduced substantially if the developed parts of the catchment are drained using traditional stormwater management methods.

Once the strategy to reduce imperviousness has been exhausted, the most efficient means of reducing catchment-scale stormwater impacts is to reduce the hydraulic efficiency of drainage connections between hard surfaces and streams, by retaining rainfall to allow it to infiltrate into the ground. This is essentially the theory behind most aspects of 'water sensitive urban design' (WSUD) approaches to stormwater management. It is likely that infiltration will be maximised most efficiently at source (rather than by collection in a large storage at the bottom of a sub-catchment).

The most environmentally positive uses for stormwater then will be those that support the maintenance of the natural hydrological cycle. Uses that allow filtration of rainwater into the catchment (e.g. garden/park watering), rather than exporting it from the

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[2] Booth, D.B., et al. *Management Strategies for Urban Stream Rehabilitation*. in *National Conference on Urban Stormwater: Enhancing Programs at the Local Level.* 2003. Chicago, IL: U.S. Environmental Protection Agency. URL: http://www.epa.gov/owow/nps/natlstormwater03/02Booth.pdf

[3] Walsh, C.J., *Protection of in-stream biodiversity from urban impacts: to minimize urban density or to improve drainage design?* submitted to Conservation Biology. URL: http://www.wsc.monash.edu.au/~cwalsh/pdfs/WalshCBms.pdf

[4] Groffman, P.M., et al., *Down by the riverside: urban riparian ecology.* Frontiers in Ecology and the Environment, 2003. **1**(6): p. 315-321.

catchment are most desirable. Some export of rainwater from the catchment (e.g. to the sewer after laundry use or toilet flushing) could be undertaken without impact if it results in total runoff volume and infiltration rates remaining close to pre-development levels (for example, this could be achieved by minimizing evaporation through holding in tanks).

The amount of infiltration required will depend greatly on the hydraulic conductivity of the catchment in question. This is variable over small scales, but is particularly variable across larger scales. It would be most appropriate to apply a rule on a sub-catchment basis. As a very preliminary estimate, based on broad generalizations of Melbourne hydrology, a typical aim would be to ensure infiltration of the first 15mm of rainfall in each rain event. If implemented, this level of infiltration would be likely to result in baseflow >90% of the predevelopment level. The result of such a management strategy is likely to be a substantial improvement in the ecological condition of streams draining metropolitan areas.

The applicability of WSUD is reduced as catchment imperviousness increases. For sub-catchments such as many parts of inner Melbourne, with imperviousness >80%, collection and possible exploitation of stormwater could have environmental benefits, and would probably be more feasible than widespread infiltration. For catchments up to 50% impervious, CRCFE research[5] suggests that substantial environmental benefits for receiving streams are possible if existing stormwater drainage infrastructure were retrofitted. Retrofitting of large parts of metropolitan Melbourne would require a sea change in attitude by the planners, architects, engineers and the general public. If a long-term view is taken such a change is possible. Over a period of 50 years, the progressive replacement of existing drainage infrastructure with more environmentally sensitive design would be feasible at little or no extra cost than existing maintenance and replacement budgets.

[5] Walsh, C.J. and T.D. Fletcher, *Drainage connection: the key to predicting urban degradation of streams.* Unpublished manuscript. URL: http://www.wsc.monash.edu.au/~cwalsh/pdfs/WFJAWRAms.pdf