Managing stormwater at the catchment scale

Little Stringybark & Dobsons Creek Projects
Fact Sheet Series: 1

The Little Stringybark Creek (LSC) and Dobsons Creek projects were long-term catchment-scale experiments designed to test if Stormwater Control Measures (SCMs)—primarily rainwater tanks, raingardens and infiltration systems—applied across an urban catchment can help restore stream condition. Commencing in 2008, the projects were led by The University of Melbourne and Melbourne Water, in collaboration with local government, industry, and property owners. We monitored changes to stream water quality, hydrology, and ecology (Fact Sheet 10), and also assessed techniques for local government collaboration (Fact Sheets 3 & 4), community engagement (Fact Sheet 5), as well as SCM design, performance and maintenance (Fact Sheets 6 & 7).

About the fact sheets

These fact sheets summarise our scientific and practical findings and insights on catchment-scale stormwater management over the long-term LSC and Dobsons Creek projects. We hope that they might inform and guide the planning and delivery of future waterways management projects for improved stream health.

'Whole-of-catchment' stormwater management

The aim of both the LSC and Dobsons Creek projects was to, as close to possible, fully disconnect impervious surfaces within their respective catchments from the stormwater drainage network. The two projects collectively constructed nearly 1,000 SCMs (620 at LSC and 372 at Dobsons Creek). The majority of these were located on private land and mainly consisted of rainwater tanks designed for water harvesting for reuse (e.g. toilet flushing) and localised infiltration. Participation by homeowners was encouraged through multiple incentive programs (see Fact Sheet 5). Public land installations included a wider variety of SCMs such as rainwater tanks, raingardens, vegetated infiltration basins, swales, and membrane filters. These public SCMs were designed, constructed and operated in collaboration with local government and varied in surface area (2 m^2- 1900 m^2) and the area of impervious surface they treated (80 m^2- 5 ha). SCMs in both projects were designed to higher

Findings and insights

1. Treating stormwater at the source can improve waterway health
2. Achieving hydrologic targets requires intervening at multiple scales
3. Retrofitting a catchment is a significant, but worthwhile, investment
4. Careful monitoring of changes in the catchment's impervious surfaces is important
5. Stormwater treatment is only one step towards stream restoration
6. There is more than one way to achieve catchment-scale disconnection

See over for more details

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standards (i.e., above that required by the Victoria Planning Provisions, which apply the pollution load reduction targets described by EPA Victoria (2021a)) which targeted restoration of both water quality and important elements of the natural flow regime. These higher standards were more akin to the water quality and flow targets described by EPA Victoria (2021a).

Our intensive installation of SCMs across the LSC and Dobsons Creek catchments meant we were able to intercept and treat a higher proportion of catchment stormwater runoff than had been attempted anywhere previously. Effective imperviousness (EI) is the proportion of the catchment covered by impervious surfaces (areas of hard materials that water cannot soak through, such as roads, roofs and carparks) that are connected to the stormwater drainage network. Stream degradation is strongly correlated with increasing EI, with ecological indicators negatively impacted beyond ~2%. The initial EI across the six catchments and sub-catchments (four at LSC, two at Dobsons Creek) ranged from 1.9 – 22.4%. SCM installations resulted in EI reductions of 0.2 – 5.8%. In four out of the six catchments and sub-catchments, EI was reduced to less than 3%, a level close to that considered conducive to improvements in aspects of stream health (see Fact Sheet 10).

Infiltration wetland, Mount Evelyn.

Project findings and insights

1. Treating stormwater at the source can improve waterway health. The projects showed that, with effective treatment by SCMs of a high proportion of impervious surfaces, and given sufficient time, it is possible to increase the environmental values of degraded waterways or at least begin to reverse the trend of degradation (see Fact Sheet 10). This is especially true for urban catchments with moderate levels of effective imperviousness (2-10%), where waterways are more likely to have retained some environmental value. In this, the LSC and Dobsons Creek projects provide a powerful proof-of-concept that distributed application of SCMs can protect or improve the health of urban streams.

2. Achieving hydrologic targets requires intervening at multiple scales. End-of-pipe SCMs (e.g. large stormwater wetlands on public land) can appear more attractive than dispersed SCMs because it means building and operating one asset for a relatively large catchment area. However, in existing urban areas it can be challenging to have a sufficiently large (non-potable) demand for the stormwater stored in end-of-pipe SCMs to keep enough water out of streams, even if available space permits their construction. It would either need a very large demand near the collection point (unlikely) or a third-pipe system to convey treated stormwater to distributed demands (likely to be prohibitively expensive and logistically challenging). Intervening at multiple scales is therefore the recommended option, building SCMs where supply is in proximity to the largest demands (i.e. at the lot-scale) and where streetscape- and precinct-scale systems are used to treat stormwater not captured the lot-scale (e.g. road runoff). Additionally, treating stormwater at the source can better protect the upper reaches (or headwaters) of streams, those sections of the stream located above any end-of-pipe solution.

3. Retrofitting a catchment is a significant, but worthwhile, investment. The cost of widespread retrofitting of an existing urban catchment to the level necessary to see an improvement in waterway health can be significant. Retrofitting also comes with the risk that not all impervious surfaces can be treated. For example, there may be insufficient space to construct SCMs in highly urban areas, unwilling property owners (as was the case at some locations for the LSC and Dobsons Creek projects), or that SCM opportunities may need to be more progressive and longer-term as part of ongoing infill development. On the other hand, efforts to install SCMs in parallel with new urban development, with the aim to protect, rather than restore already-degraded waterways, may have the added benefit of being more feasible and cost effective in the shorter term.

4. Careful monitoring of changes in the catchment's impervious surfaces is important. Knowledge of the impervious surfaces within a catchment (including surface area and degree of connection to the stormwater drainage network) is necessary for first establishing and then tracking the progress towards EI targets. The LSC project was diligent in measuring impervious surfaces in the catchment connected to, and thus impacting upon, the creek, both prior to and during the project's delivery. We did so using measurements from aerial photography (both automated through GIS and manual), with consideration of the formal drainage infrastructure. Importantly, the project also monitored the growth of new impervious surfaces in the catchment – which were significant. Accurate records of the impervious surfaces connected to each SCM were also kept. These data also help avoid unnecessary duplication of treatment such as multiple SCMs treating the same impervious surfaces.

5. Stormwater treatment is only one step towards stream restoration. In catchments with high effective imperviousness and severely degraded streams, additional stream restoration works may be needed to realise the full benefits provided by stormwater interventions. For example, severely channelised streams may require physical intervention to reinstate a more natural or functional channel profile (e.g. to reengage the stream with the floodplain) or reinstall large woody debris—such as logs and branches—to increase habitat complexity, restore natural geomorphic processes and support aquatic biodiversity.

6. There is more than one way to achieve catchment-scale disconnection. The LSC and Dobsons Creek projects invested significant effort and funding in a relatively short time span. This was necessary to provide a proof-of-concept regarding the potential of SCMs to protect or improve the health of waterways in existing urban areas. Of course, this is not the only way to achieve catchment disconnection. Indeed, given the magnitude of upfront funding required, such an approach is unlikely to be widely adopted by waterway managers. Instead, waterway managers could consider the timescale at which restoration can take place, potentially viewing it as a long-term (50+ years) restoration effort. With this perspective, managers can progressively treat stormwater as opportunities present themselves (e.g. as part of urban renewal projects or drainage infrastructure improvement and replacement programs). Additionally, the inclusion of planning controls that require a high standard of stormwater treatment for any new or modified impervious surfaces will, if consistently applied, eventually lead to whole-of-catchment treatment (see Fact Sheet 4).

Residential water tank, Mount Evelyn.

For more details on the outcomes of this project, please refer to:

- Walsh, C. J., D. G. Bos, M. J. Burns, M. Imberger and T. D. Fletcher (2023), "Restoring the health of urban streams through stormwater management: A synthesis of the Little Stringybark and Dobsons Creek research projects", Technical report 23.2, Melbourne Waterway Research-Practice Partnership.
- Little Stringybark Creek and Dobsons Creek Projects: Fact Sheet Series
  1. Managing Stormwater at the Catchment Scale
  2. Collaborative Stormwater Management: Co-design and Co-delivery for Long-Term Success
  3. Collaborating with Local Government on Stormwater Management
  4. Enacting Stormwater Management through Local Government Planning Schemes
  5. Enhancing Community Engagement and Participation in Stormwater Management
  6. Design and Performance of Stormwater Control Measures for Stream Protection
  7. Operation and Maintenance of Stormwater Control Measures for Stream Protection
  8. The Stormwater Metric 'S': A Tool for Predicting Benefits from Improved Stormwater Management
  9. Monitoring the Effectiveness of Stormwater Control Measures
  10. Stream Health Response to Catchment-Scale Stormwater Management