

Reflections in the stream (Part 1): What can we learn from 30 years of urban and rural waterway management?

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Key points

- Over the 30 years of the Australian Stream Management Conference, there has been an equally interesting evolution in urban and rural waterway management in Greater Melbourne. We provide here a reflective perspective, by way of Greater Melbourne as a case study, from a waterway management authority, academic and consultant.
- Examples capture evolving issues, priorities, management approaches and catalysts. We specifically identify periods and strategic actions that led to major gains in improving waterway health, as well as those actions (or inactions) that hampered progress.
- Our goal is to ‘look back to look forward’, to learn and structure guidance for waterway management in Australia over the next 30 years and beyond: See the companion 12ASM paper by the same authors – Ripples in the stream (Part 2): What might the next 30 years of waterway management look like?

Abstract

As the Australian Stream Management conference achieves its 30th Anniversary, and with the conference theme being *Living and evolving with change*, we reflected on the last 30 years of waterway management. We use an example of Greater Melbourne, a management area incorporating forested, rural and urban waterways in a rapidly urbanizing setting. It is also a region where significant investment and advancements have been made in waterway management, and where all three authors have been active over this period. We provide examples of how the context and approach to waterway management have changed, and highlight key moments that have propelled us forward or held us back as an industry.

We provide complementary perspectives from a management authority, academic and consultant. Drawing on contrasting experiences, we captured evolving issues and priorities, changes to strategic planning, works programs, monitoring, and stakeholder engagement. Our exploration identified points in time where major gains in improving waterway health were made (e.g. guidance, legislation, stormwater targets), and conversely, where challenges hampered or even reversed progress (e.g. lack of investment in industry capacity).

Factors that helped or hindered the evolution of waterway management include enabling governance structures, strategic management frameworks to focus efforts and justify public investment, collaborative research to build knowledge and establish ‘trusted voices’, champions to advocate for change, fluctuating industry risk appetite, and economic climate. Broad-scale external stressors also a major influence, such as the millennium drought, major floods and the COVID-19 globally pandemic.

There is much we can be proud of over the past 30 years, but also much to be learned from what didn’t go well (and we all too rarely see these examples in papers). This paper doesn’t claim to have all the answers or all the perspectives, but it is able to draw upon the wisdom of hindsight to provide a structure and basis that might better propel our industry forward. In a companion paper by the same authors, we explore how these lessons might strengthen stream management over the next 30 years.

Keywords

Evolving practice, change in management, history of stream management, Melbourne.

Introduction

The 12th Australian Stream Management (12ASM) conference in 2026 marks the 30th Anniversary of the conference. Given the theme of 12ASM — *Living and evolving with change* — we felt it fitting to reflect on the last 30 years of waterway management in Greater Melbourne as a case study – where we have been active in urban and rural waterway management for the same period of time. We aim to describe how the context and approach to waterway management changed over recent decades and to uncover what we might learn from these changes, identifying points in time where and why there were major steps forward in our ability to protect and improve the health of Greater Melbourne’s streams. We were also interested in points in time and circumstances that hampered the advancement of waterway management across the region. Each of the authors have experience in various roles within waterway management authorities, academia and/or consulting, and through the lens of these complementary perspectives, we considered evolving issues and priorities for waterway management, approaches to strategic planning, the maturing of stream works programs, how we undertake monitoring and assessment of waterway health, and the way we have undertaken stakeholder engagement. This paper is a non-exhaustive review of factors, based on collective discussions; we considered notable shifts (backward and forward) in waterway and catchment management understanding, approaches and policy. Additional complementary perspectives on waterway management in Melbourne can be found in Hart et al. (2021). We provide examples and corresponding lessons, in the hope that this work inspires further analyses to validate and expand on these lessons, involving a broader team of authors spanning multiple regions across Australia (see for example Russell et al. 2023 as a structured review of the ASM proceedings).

Whilst we might not be able to predict the catalysts of change (the unknowns), how prepared we are to respond to them should be knowable. This will increase the chance of successful waterway management for the next 30 years. This paper has a companion 12ASM paper that considers how these knowns might advance waterway management over the next 30 years – *Ripples in the stream (Part 2): What might the next 30 years of waterway management look like?* (Vietz et al. 2026).

Evolving issues, priorities and approaches

We propose five themes to categorise waterway management evolution: 1) shifting narrative of waterway management priorities, 2) focus threats and responses, 3) how strategic planning drives priorities, 4) evolution of waterway management actions, 5) waterway monitoring and assessment improvements and 6) increasing community and cultural connection to waterways. Examples under each of these themes, ordered by decades between the 1990s and 2020s, are provided in Table 1.

Table 1 Examples of the evolution of waterway management in Greater Melbourne 1990s-2020s

Theme	1990s	2000s	2010s	2020s
1. Shifting narrative of waterway management priorities	Waterway management shifts from a focus on flood protection and water quality to include broader consideration of ecosystem health. Waterways more formally recognised in urban planning.	Impacts of stormwater on the health of bays and subsequently streams, recognized as a primary threat. Acknowledge that some erosion, flooding, and large wood beneficial for waterway health. Need for environmental watering of rivers and floodplains, provision of fish passage and leave/introduce wood in streams.	Stormwater management becomes part of a broader future of water security and city liveability message and the need for Integrated Water Management across multiple water sources.	Increased focus on understanding the social, cultural and wellbeing values of waterways. Rivers as ‘Living Entities’, including legal recognition of the Birrarung (Yarra River).
2. Focus threats and responses	Flooding as a social impact	Drought Urban stormwater quality	Drought recovery Climate change as a future likelihood	Climate change as a core driver Flooding frequency and magnitude

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Theme	1990s	2000s	2010s	2020s
	Pollution e.g. nutrients, sediments, heavy metals, faecal microbes. Stream erosion Riparian weeds Large wood as a flooding and erosion impact Drought	Flow stress Loss of instream connectivity for fish	Urban stormwater quantity Agricultural runoff Piping of headwater streams and wetlands Emerging contaminants of concern e.g. pesticides and pharmaceuticals Protection of waterway corridors	Urban stormwater restoration of flow regimes Loss of headwater streams and wetlands Emerging contaminants of concern e.g. pesticides, pharmaceuticals Pest animals e.g. deer
3. How strategic planning drives priorities	An emerging shift from reactive to strategic works Internal frameworks developing in late 1990s for issue identification and works prioritisation and program delivery e.g. Melbourne Water local waterway activity plans, water quality strategy.	A move toward proactive works prioritisation and implementation. Release of the first Victorian River Health Strategy and formal strategic planning framework Melbourne Water develops the first Regional River Health Strategy and separate Stormwater Strategy for Greater Melbourne.	More holistic water management: the era of IWM (Integrated Water Management) strategies. Integration of stormwater and waterway management strategies, as well as inclusion of wetlands and estuaries. Introduction of quantitative and systematic conservation planning tools. Move from Melbourne Water only in late 2010s to a multi-partner strategy.	Integration of catchments and waterways strategies. Increased explicit linkages between development, streamflow components, and values implicated. Increasing recognition of the importance of the ‘business case’ to monetise benefits.
4. Evolution of waterway management actions	Streamside revegetation and weed control (including willow removal) programs commence Stream stabilization with hard materials e.g. concrete, rock	Stormwater Management through Water Sensitive Urban Design commences. Greater emphasis on environmental watering through streamflow management plans. Fishway programs expand. Reintroduction of Large Wood beginning to occur.	Integrated Water Management becomes an increasing focus. Stream naturalisation and daylighting projects (to address historical waterway piping and concrete lining) commence.	WSUD advances, although Business-As-Usual development still dominates catchment & waterway planning e.g. piping or widening of headwater streams. Opportunities to connect channels and floodplains increase e.g. lower Birrarung billabong watering. Real-time control of WSUD Assets (e.g. rainwater tanks, urban lakes, wetlands) on public & private land. Emerging ‘Room for the river’ waterway delineation and corridor protection.
5. Waterway monitoring and assessment improvements	From a focus on water quality (especially nutrients, sediments, metals, faecal microbes), to incorporation of biological monitoring (e.g. aquatic macroinvertebrates, fish, platypus). Waterway health metrics introduced e.g. Index of Stream Condition	Emerging technologies to support stream condition and health studies e.g. Remote sensing of vegetation extent, acoustic tracking of fish	Development of a formal Monitoring, Evaluation, Reporting & Improvement (MERI) Framework to track strategy progress. Emerging technologies to support stream condition and health studies e.g. environmental DNA for aquatic biodiversity monitoring, passive samplers for emerging contaminants.	Real-time monitoring and control of stormwater assets. Increasing computer power and AI to support access to, and analysis of, large datasets.
6. Increasing community and cultural connections to waterways	Community perceptions of streams shifting from ‘drains’ to ‘rivers’ Citizen science programs commence e.g. Streamwatch/ Waterwatch Stream Frontage Management program commences Local waterway activity planning with local government and other key stakeholders	Strengthening perceptions of streams as ‘ecosystems’ Shift from local waterway planning to region-wide strategic planning and stakeholder consultation	Explicit ecological and social values are associated with waterways. Regional strategic waterway management planning founded on co-design & delivery with stakeholders. Traditional Owner partnerships, ownership and self-determined strategies. Recognition of ‘living rivers’ e.g. Birrarung Act	Traditional Owner partnerships with Melbourne Water established to underpin TO-led management of priority waterways Increasing role of the community in waterway management e.g. advocacy and stewardship through citizen science apps, smart tanks etc.

Ebbs and flows

The themes captured in Table 1 provide some of the evolving issues, priorities, management approaches and catalysts for change. This forms the basis to identify important shifts in waterway management practices that both help and hinder progress. From this we identify factors that we believe helped waterway management practices evolve as ‘flows’ that progress our industry, and ‘ebbs’ that have held us back.

Flows

Enabling policy, legislation and governance structures

Waterway management across Australia involves a diversity of organisations, some of which separately oversee key elements at different catchment scales, such as waterway channels, floodplains and stormwater. The increasing integration of responsibilities for catchment, landscape and waterway management has provided significant impetus for the ‘flow-on’ effects in our industry realized over the last 30 years.

The benefit of the Greater Melbourne region as a case study is that Melbourne Water is the waterway manager under the *Water Act 1989*, giving it waterway management responsibilities in the Port Phillip and Westernport region. In the mid 1990s, the Melbourne Metropolitan Board of Works (MMBW) transitioned to Melbourne Water, including the integration of other organisations such as the Dandenong Valley Authority. As part of the formation of Melbourne Water, a dedicated Waterways and Environment Team was established in the Drainage group to ensure an increased focus on waterway health management as opposed to solely drainage and flood protection functions. Some of the works programs managed by the Waterways and Environment Team included the Stream Frontage Management Program, focused on revegetation and fencing of riparian zones, stream stabilisation works, and reach-scale focused Waterway Activity Plan development. This team also included strategy development and waterway health monitoring and investigation functions. Government policy, such as the Victorian River Health Strategy (see *Strategic Management Frameworks* below), and legislation, such as the ecological objectives in the *Environment Protection Act 1970* State Environment Protection Policies, were important drivers for these functions.

While Melbourne Water had a waterway management responsibility, it did not initially extend to catchment management. That was the responsibility of the Port Phillip and Westernport Catchment Management Authority (PPWP CMA). This changed in 2022 when the PPWP CMA was merged with Melbourne Water. While Melbourne Water is now the waterway and catchment manager for the Port Phillip and Westernport region, there are several organisations that have a strong influence on waterway health e.g. DEECA, EPA Victoria, Parks Victoria, Retail Water Companies, Local Government, Southern Rural Water. Effective waterway management outcomes for the region therefore require establishment of strong interagency collaboration (see *Strategic Management Frameworks* below).

More recently, important community and culturally-led programs include the *Yarra River Protection (Wilip-gin Birrarung murrnong) Act 2017* (the Birrarung Act), which was a major shift in the formal recognition of the Birrarung (Yarra River) as a natural living entity. The act also sets out principles for decisions affecting the river and its land, and a framework for the community’s 50-Year Vision and Burndap Birrarung burndap umarkoo (Yarra Strategic Plan) 2022-2032. The long-term strategy for Victoria’s water resources, *Water for Victoria* (2016), and more recently *Water is Life: Traditional Owner Access to Water Roadmap* (DELWP 2022), advance Traditional Owner engagement, self-determination and decision-making in water management.

Key lessons: *Waterway management requires the ‘focus’ of a lead organization, but multi-agency collaboration – including with the community – is essential.*

Strategic management frameworks

A move from reactive to proactive waterway management planning is critical for successful protection and restoration of waterways (Russell et al., 2023). In the 1990s, waterway management planning within the Melbourne Region relied largely on the knowledge and expertise of staff within Melbourne Water to identify management priorities and shape works programs. This was progressively supported through local level plans – Waterway Activity Plans — rolled out with key stakeholders (e.g. local government, Friends groups). The introduction of the Victorian River Health Strategy (VRHS) (DNRE 2002) provided the state policy framework for managing waterways over the period of 2002 to 2012. This strategy, and subsequent Victorian Waterway Management Strategy (2013), identified the need for holistic waterway management strategies for each of the regions across Victoria, including Greater Melbourne. While Melbourne Water had developed high-level water quality and waterway management plans towards the late 1990s, the VRHS led to the development of the first waterway management strategy for the region, known as the Regional River Health Strategy (Melbourne Water, 2007a). In parallel there was also a separate Stormwater Management Strategy (Melbourne Water, 2007b). The Victorian waterway management strategies not only provided a consistent framework for waterway management planning for Catchment Management Authorities across Victoria, including Melbourne Water, they provided an important mandate for waterway management investment across a range of environment, social, economic and cultural values, and threats to those values.

Using available waterway health data (especially the Index of Stream Condition) and knowledge of Melbourne Water staff, the 5-year Regional River Health Strategy used a systematic, mostly qualitative, risk-based approach that considered both waterway threats and environmental, social and economic values to identify works programs, priority actions and management targets. Importantly, the strategy provided a firm basis for a substantial increase the funding and staff required to deliver the works programs. The consistent funding base through Greater Melbourne’s annual drainage rate has been an important element of Melbourne Water’s success in delivering a broadscale and complex waterway management program for urban and rural waterways across strategy development, works delivery and maintenance, research and stakeholder engagement. This funding model, overseen by Victoria’s Essential Services Commission (ESC), differs from that of other Catchment Management Authorities within Victoria. Additionally, having to justify a 5-year waterway management program to the ESC is an important discipline to ensure programs are prudent and efficient, and are strategically aligned with Victorian Government policy and legislation and reflect community expectations.

Following the Regional River Health Strategy, the subsequent two strategies were referred to as our Healthy Waterways Strategies (released in 2013 and 2018). The Healthy Waterways Strategy 2018-2028 made three large advances. Firstly, it extended the strategy life to 10 years, and integrated rivers, estuaries and wetlands, and stormwater, in recognition of stormwater management as an important driver of waterway health. Secondly, for the first time it included a quantitative systematic conservation planning approach through the incorporation of Habitat Suitability Modelling and works prioritization with Zonation (Chee et al. 2020), increasing the rigour of predictions of environmental values, the likely impacts of future threats (e.g. urban growth, climate change) and the most cost-effective management actions. This approach also enabled setting of quantitative management targets. More recent strategies also placed a greater emphasis on the social (amenity, recreation and community connection) and cultural values of waterways, although these elements represent areas where there is opportunity to continue to mature the approach, most notably in relation to effective Traditional Owner engagement and how their priorities are reflected in waterway management priorities. Finally, the current HWS shifted from a Melbourne Water owned strategy to a strategy shared by multiple organisations and the community, founded on co-design and co-delivery (Melbourne Water 2018).

Key lessons: *Holistic strategic planning is critical to make effective use of limited waterway management resources. The strategy should be developed and implemented with the community.*

Collaborative research

The original focus of ASM was to bridge the divide between the science and management of waterways; this is also a common medium to long-term goal for ensuring progress in waterway management. Collaborative research programs are important in establishing industry networks between waterway managers, researchers and consultants, to ensure shared understanding of industry challenges and facilitate knowledge exchange and research adoption. Research collaborations have also been critical for establishing ‘trusted voices’ to help advocate and support industry changes. Demonstrating tangible linkages between the research and management is important to developing the industry and critical to demonstrate to funders the need for ongoing research.

Important examples of such collaborations are the nationwide Cooperative Research Centres (CRCs) for Freshwater Ecology, Catchment Hydrology, eWater and Water Sensitive Cities. For the Greater Melbourne Region specifically, collaborative research programs since the 1990s were fundamental in maturing our understanding of waterway management threats and opportunities, including the development of tools, frameworks and methods to support waterway management planning, setting of strategic management targets and implementation of works. Strategic research partnerships – including the Melbourne Waterway Research-Practice Partnership between Melbourne Water and The University of Melbourne, and the Aquatic Pollution Prevention Partnership (A3P) between Melbourne Water and RMIT University – have been important for supporting the delivery of priority knowledge gaps identified in the HWS.

Some of the important advances during the past 30 years have resulted from research collaborations and been driven by collectives of industry champions (see *Industry Champions* below). Notable examples include the Port Phillip Bay Environmental Study (CSIRO 1996) and the subsequent nitrogen targets for Port Phillip which underpinned stormwater management development planning requirements (e.g. Clause 56 of the Victorian Planning Provisions), Best Practice Water Sensitive Design guidelines (e.g. CSIRO 1999) and design tools (e.g. MUSIC). The Little Stringybark and Dobsons Creek catchment-scale stormwater management interventions were fundamental in underpinning improved stormwater practices in the region (Walsh and Fletcher 2015). These advances arguably positioned Melbourne as a leader in urban water research and its application. Research into the ecological importance (including downstream) and function of headwater streams across Greater Melbourne has also underpinned objectives in the HWS for the recognition and protection of headwater streams in new urban areas. Achieving this, similar to the Little Stringybark and Dobsons creeks projects, requires Melbourne Water and its partners to shift attention to managing catchment stressors to waterways (e.g. ‘at source’ treatment of stormwater at the lot and streetscape scale) to complement a traditional focus on management actions within waterways (e.g. streamside vegetation management).

Key lessons: *Waterway managers confront uncertainty about the effectiveness of their actions; long-term collaborative research is critical for evidence-based decision making, setting of strategic management targets and to improve the efficacy and efficiency of management actions.*

Industry champions

On reflecting of the evolution of waterway management in Table 1 it is clear that, while having a solid evidence base for change was important, these shifts may not have been possible (or at least may have been much slower to progress) without key ‘champions’. These champions often comprised senior researchers or managers with sufficient seniority and influence, who were able to articulate a clear and compelling narrative for change, were a credible and ‘trusted’ voice to government, and had the courage and persistence required (over multiple years) to see change. Indeed, the evolution of stormwater management in Greater Melbourne is a good example of the role of champions across

academia, consulting, Melbourne Water and Government in achieving small wins over many years. Some key initiatives can be linked to a relatively small ‘network of champions’.

Key lessons: *Champions are essential – and their ‘regeneration’ depends on fostering the next generation of champions across organisations*

Natural and human stressors

Natural stressors, such as droughts and floods, have put a spotlight on waterway management issues more broadly across government and the community. The Millenium Drought (1997-2009) led to a dramatic push on related strategies. For example, the Victorian environmental flow recommendations method (FLOWS method) was developed in 2001 and applied consistently for a decade to regulated systems. Urban development as a stressor was most evident in the 2010s, with rapid growth and 40,000 dwellings per year being constructed, half within greenfield development (Vietz et al., 2014). This led to recognition of the pressure on waterways, and a push towards provision of appropriate streamflows within urban catchments (e.g. Fletcher et al., 2014).

In cases where the knowledge, research and industry capability were ready and sufficiently mature, we were able to make some significant gains e.g. stormwater management as an alternative water source during drought conditions, environmental watering. More recently, major flooding across Melbourne has arguably led to increased interest in new approaches to reducing flood risks in urban areas, such as smart rainwater tanks that are able to perform releases prior to storm events, to increase stormwater detention. The COVID-19 global pandemic increased connections and desire for blue and green spaces (Hatt et al. 2023), reinforcing the perception by communities of the value of waterways as places of recreation and connection to nature. This has helped support the trend towards seeing waterway management as part of enhancing liveability in urban areas, and increasingly ‘healthy rivers’ as a focal point for regional living.

Key lessons: *Crises represent an opportunity for change; waterway managers need to have their arguments and ideas ready, as time to act may be limited.*

Ebbs

Industry capacity

At times, a lack of capacity in the industry has restricted stream management progress and risks industry and stakeholder backlash on the perceived ineffectiveness of new asset types that may not be effectively designed, built or maintained. A good example of this are WSUD assets, which in some cases where capacity has been limited and WSUD assets poorly designed, constructed or not maintained appropriately, it has led to negative perceptions about WSUD performance and resistance of them being further implemented or investment in their maintenance. A lack of clarity on asset ownership and benefits also had the potential to result in little or no investment in WSUD maintenance, further contributing to negative perceptions of WSUD assets. The risk of potential backlash from insufficient industry capacity in parallel with new policy or legislation, is highlighted in Transitions Dynamics theory (e.g. Brown et al., 2013; Water Sensitive Cities, 2022). Capacity building programs, such as Clearwater, dedicated subjects within University curricula and other technical training courses (e.g. MUSIC), and various design guidelines (e.g. Melbourne Water stormwater wetland design manual) have been important pathways increasing our maturity in stormwater management.

Whether it be capacity or capabilities, if we don’t have the required depth of knowledge within organisations, we risk business-as-usual-outcomes dominating at the expense of innovation. Realm knowledge, and a clear case for change, strongly position organisations to be able to challenge the status quo or to ensure that the intent of existing policy and legislation is met. Examples include WSUD, natural channel design, and ‘room for the river’ concepts, but change takes time. Over the 30 years, for example, there has been a significant shift in the use of concrete as a waterway stabilization medium; we are now removing concrete from waterways in the last decade. This shift ultimately led to

strategic objectives in the HWS for increasing the social values of Melbourne's waterways (e.g. 'daylighting' and 'naturalisation' programs). Would the waterway managers of the 1990s have expected this to be the case? The question is an important one when we think about the use of rock within the context of 'living rivers' and what waterway management attitudes and practices might evolve over the next 30 years.

Key lessons: *Without ongoing industry capacity-building, we risk poor decisions and outcomes. We must invest in knowledge and leadership.*

Economic climate and industry risk appetite

In parallel with the release of the Regional River Health Strategy (Melbourne Water 2007) there was substantial growth in budgets and human resources for waterway management across the region, as well as growing emphasis on innovation. However, not long after, external economic pressures (e.g. Global Financial Crisis) and budget reductions has made it more difficult to innovate, expand asset types and resource new programs. Innovation activities, where additional resources were required, risked being deprioritized with a need to focus on core activities. Where potential new management approaches are untested, there may also be uncertainty regarding their cost relative to the benefits. In addition, it may be challenging to imbed new initiatives where there is a need for a significant shift in expertise and emphasis from Business-as-usual activities. The importance of demonstration projects to support such shifts to stormwater management in the late 1990s was highlighted by Brown et al. (2013), using the Lynbrook Estate WSUD site as an example.

Key lessons: *Progress requires responsible risk-taking; we need to promote 'safe to fail' organizational cultures that recognize the importance of innovation to solving current and future challenges.*

Discussion

Stream management practices in Greater Melbourne have evolved substantially over the past 30 years, including the enabling policy and legislative environment, maturing tools and frameworks for strategic planning, expansion of works programs and increased efficiency and effectiveness of restoration approaches, new technologies to support waterway health monitoring and assessment, and increased opportunities for meaningful stakeholder engagement. Clearly there is much that we can be proud of over this time as a relatively new industry (in comparison to water supply and treatment). We can be proud of our continued and long-term investment research partnerships that have provided an evidence base for change, and pathways to research adoption and improvement, as well as providing platforms for stakeholder engagement and genuine co-design and co-delivery of waterway strategies. While there is still a long way to go, we can also be proud of increasing instances of Traditional Owner-led management of waterways, such as the management of billabongs along the lower Birrarung/Yarra River.

Over 30 years we have seen the breaking down of barriers to cross-jurisdictional and cross-discipline responsibilities for management leading to a realisation of broader-scale wins. We have also seen strategic advancements that build upon research and are translated by industry collaboration into activities, policies and key initiatives by groups, or even a couple of key leaders in the field (recognising the power of the individual).

We also want to learn from mistakes of the past, such as once using willows, concrete pipes, concrete-lined channels or rocks to prevent erosion of stream channels, which subsequently required reversal. By reflecting on key shifts in waterway management over the past 30 years, we were able to highlight factors that we believe facilitated and contributed to slowing stream management advances across Greater Melbourne; points in time where the 'flows' led to major gains in waterway health improvement (e.g. stormwater targets), or conversely, ebbs that challenged progress (e.g. industry capacity). Factors that helped or hindered the evolution of waterway management include enabling governance structures, strategic management and prioritisation, collaborative research to build knowledge,

champions to advocate for change ('trusted voices'), fluctuating risk appetite, and economic climate. External stressors such as floods or droughts also facilitated change.

These reflections allow us to look forward to the potential ripples to be made, such as with climate change or urban growth. Our readiness, with the evidence base and clear narrative for change, providing a robust flowpath. This requires taking advantage of new technologies, proof-of-concept through demonstration projects, enabling policies and legislation, robust governance structures, capacity building programs and continuous improvement through monitoring and evaluation of interventions. Ultimately, we should strive for progressive steps in the right direction, at times requiring some level of pragmatism, and seizing ground wherever possible rather than risk any gains at all. We propose to reflect on the mistakes of our past, our ebbs, and the beneficial actions that saw flow, and for this we refer you to the companion paper in this proceedings to see where the 'ripples in the stream' can take us (see Vietz et al. 2026).

Conclusions

This paper tries to draw upon the wisdom of hindsight to better propel our industry forward. In a companion paper, we explore how these lessons might strengthen stream management over the next 30 years.

Acknowledgements

We thank the Australian stream management industry for its efforts over the past 30 years; government agencies, waterway management authorities, researchers, consultants and community groups who all invest passionately in the protection and improvement of our precious waterways. Fletcher is supported by ARC Industry Laureate (IL230100020). Thanks to Ian Rutherford for useful comments on the draft paper.

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