# Ten years of learning from catchment-scale stream stabilisation: Lessons from Laidley Creek, South East Queensland

Vanessa Durand[1], Sam Morison[2] and Ross Bigwood[3]

*1 Healthy Land & Water, Brisbane, QLD, 4014. Email: vanessa.d@hlw.org.au*

*2 Healthy Land & Water, Brisbane, QLD, 4014. Email: samuel.m@hlw.org.au*

*3 Healthy Land & Water, Brisbane, QLD, 4014. Email: ross.b@hlw.org.au*

**Key points**

- Long-term, reach-scale remediation combining soft engineered works and riparian revegetation has significantly increase channel stability and reduced sediment loss.
- LiDAR-based monitoring provides efficient monitoring of bank stability.
- Riparian revegetation is essential for long-term resilience but requires targeted species selection and planting strategies and early intensive management.
- Ongoing landholder engagement, supported by clear exposition of benefits and risks are critical to scaling remediation efforts across the catchment.

## Abstract

The Laidley Creek Remediation Masterplan ("Masterplan") represents a decade-long, catchment-scale response to severe channel instability in Laidley Creek, South East Queensland (SEQ) following the 2011 and 2013 flood events. Laidley Creek is one of several highly modified streams that drain into the Lockyer Creek, which contribute a significant proportion of fine sediment pollution in Moreton Bay in comparison to other catchments.

Following significant channel erosion during the 2011 and 2013 floods, Laidley Creek was identified as a priority investment area to address sediment loss and provide long-term stream stabilisation.

Early strategic planning established a long-term vision that has guided more than 10 years of progressive stabilisation works. Since an initial pilot project funded by Port of Brisbane Pty Limited in 2015, approximately 6 km of creek banks have been stabilised using a mix of engineering and riparian rehabilitation. Healthy Land & Water has undertaken ongoing vegetation and erosion monitoring of remediated areas to assess performance and inform adaptive management. Key parameters monitored and findings include:

- The influence of cross-channel structures on creek bed stability.
- Estimation of erosion and deposition volumes using LiDAR.
- Vegetation survival and growth.
- The role of annual infill planting in riparian remediation.
- The critical role of stakeholder in achieving successful outcomes.

This paper reflects on lessons learned over ten years; and demonstrates how long-term planning, monitoring, and community partnership can improve outcomes for catchment scale remediation programs.

## Keywords

River remediation, bank stabilisation, riparian revegetation, LiDAR monitoring, adaptive management

## Introduction

Laidley Creek is located in the Lockyer Valley in South East Queensland (SEQ), approximately 100km west of Brisbane. It is a highly productive horticultural region, often referred to as the "salad bowl". Laidley creek is a major tributary within the headwaters of Lockyer Creek which flows into the Brisbane

River and finally into Moreton Bay, a RAMSAR listed semi-enclosed embayment that holds significant ecological and economic value within SEQ.

Laidley Creek has been subject to historical riparian clearing, agricultural development and repeated major flood events. The 2011 and 2013 floods accelerated bed lowering, bank widening and floodplain scour (Tozer et. al 2023). Research has identified Lockyer Creek as a dominant source of sediment to Moreton Bay, with gully and channel erosion being the dominant erosion processes within the area (Olley et al. 2006; 2024). The major flood events of 2011 and 2013 delivered substantial sediment loads to Moreton Bay, with research indicating that flood-derived fine sediments currently affect more than 98% of the bay's benthic zone, with implications for water quality, benthic habitats and seagrass-dependent fauna.

Given the disproportionate impact of erosive processes in Laidley Creek on the ecological values of Moreton Bay, remediation activities within Laidley Creek are recognised as an important component of a broader regional sediment management plan (Grinham et al. 2024). This wider context reinforces the need for remediation responses that operate over multiple spatial scales including site, reach and catchment scales, rather than relying on singular, localised interventions.

A reach scale Masterplan was devised in 2013 in response to environmental degradation and the resulting excess sediment export from Laidley Creek (Tozer et. al 2023). The overarching objective of the Masterplan is to improve the long-term stability and resilience of Laidley Creek, while at the same time:

1. Building both local and scientific capacity and understanding of riparian remediation of degraded streams.
2. Creating strong partnerships with private service providers, government entities and landholders and local communities.
3. Capturing knowledge and facilitating the inclusion of adaptive management principles.
4. Providing an investment pathway with outcomes grounded in scientific evidence.

This paper examines the approach used by practitioners to implement components of the Masterplan within a 16 km reach of Laidley Creek, and presents the key results and lessons learnt from ongoing monitoring and maintenance activities at the remediation reach.

## The Masterplan approach

The Masterplan was developed in 2013 in response to significant channel instability and bank erosion within Laidley Creek which resulted in severe environmental, social and economic impacts within the region (ABC 2013). Following detailed geomorphologic analysis of the 2011 and 2013 flood damage, the priority area for the Laidley Creek Masterplan was centered around Mulgowie, which experienced some of the worst channel erosion along the Creek during both flood events.

The reach-scale Masterplan extends approximately 16 km upstream from Mulgowie. Under the Masterplan approach, Laidley Creek was divided into reaches and sub-reaches with comparable hydraulic and geomorphic characteristics. This approach provided a strategic framework for prioritising interventions and sequencing works over time (Tozer et al. 2023). The Masterplan provides a geomorphologic description of the target Reach; and identifies, at a strategic level, the soft engineering (rock grade control structures, cross channel structures, bank battering, etc.) and riparian revegetation effort needed. It provides guidance on the sequencing of individual remediation reaches to minimise risk. Risk considerations include addressing bed deepening before bank stabilisation and early provision of surface cover and vegetation community establishment. The Masterplan guides both detailed planning for individual reach remediation; and increases confidence in the enduring benefits of these nature-based solutions for key investors. The remediation approach was guided by best available geomorphologic design and planning, and together with strong community consultation, helped forge partnerships with landholders, private sector providers and government agencies.

Remediation works under the Masterplan adhered to the principals of adaptive management, and as a result the original Masterplan was revised in 2023 to incorporate updated geomorphic changes due to flood and fire events.

## Key results and lessons learnt from onsite monitoring

The effectiveness of stream remediation is often difficult to assess due to limited and inconsistent monitoring (Freestone et al. 2026). Moreover, research suggests that adaptive management principles are not fully embedded in Australian stream management practice (Russel et al. 2023). Work conducted by Healthy Land & Water addresses these known limitations by undertaking comprehensive riparian vegetation and erosion monitoring within the restored Laidley Creek reach. The following section highlights key learnings from this ongoing work.

Since 2015, Healthy Land & Water has been delivering the works recommended in the Masterplan in iterative stages, starting downstream at the township of Mulgowie, and moving upstream as funding became available, with the following works completed to date:

- Bed grade control structures installation: Four rock chutes, six cross channel structures and three cross floodplain roughness structures .
- 6 km of bank reprofiling.
- 6 km of riparian revegetation.
- Significant community engagement and knowledge capture.

The works to date have been modelled to demonstrate an average annual reduction in sediment pollution from the remediated section of Laidley Creek by 26,000 tonnes.

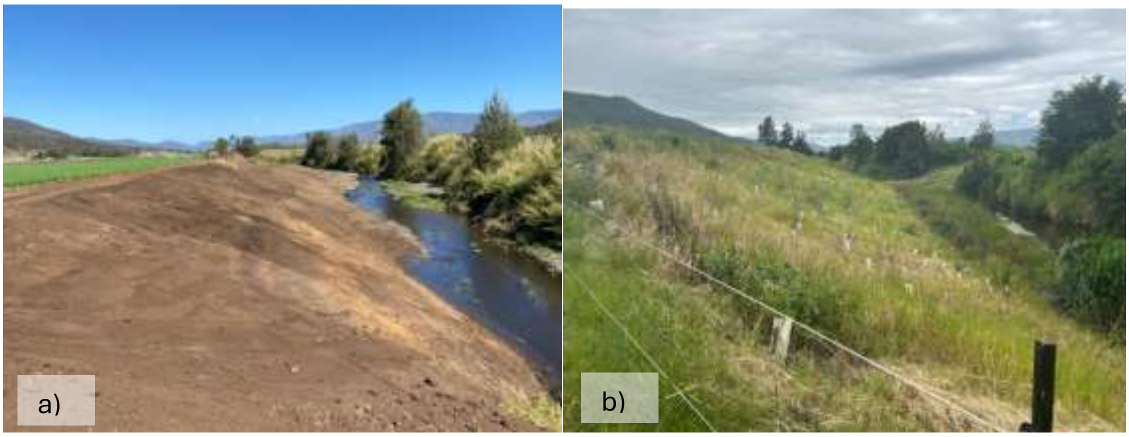


**Figure 1 Bank reprofiling a) July 2025, b) March 2026**

### *Influence of timber cross channel structures on the creek bed*

Four grade control structures were built in 2013 in accordance with the Masterplan, with the aim of stabilising bed lowering and reducing excessive bed grades. The grade control structures were supported by the installation of four rock grade control structures and four cross channel pile structures installed in 2015 and two in 2025, which specifically aimed to slow flows operating on the bed and banks.

Photographic and LiDAR evidence confirms the grade control and cross channel structures are achieving their design purpose, including reducing stream velocities and shear forces acting on banks.

For instance, Figure 2 highlights the build-up of bed material and the formation of a bench on the upstream end of a cross-channel structure, and the commencement of bench revegetation. Figure 3 illustrates LiDAR comparisons between 2023 and 2024 downstream of a cross-channel pile structure. The figure shows evidence of in-channel deposition. Despite a large degree of success, bank eddy scour immediately downstream of the cross-channel structures has been observed. In line with adaptive management principles, this observation has resulted in design modifications, such as increasing the extent of bank toe rock armoring in the 2025 project implementation. The data collected to date continues to support the premise that the timber cross channel structures are acting as effective grade control structures (Parker et al. 2023), creating upstream in channel deposition and downstream scour pool (Rutherfurd et al, 2000).

**Figure 2 Cross channel structure looking downstream, with sediment deposition upstream and the formation of a bench that is commencing to revegetate (08/10/2024)**


**Figure 3 2023 and 2024 comparison of revegetation at a cross channel pilefield, showing development of an upstream bench and riparian vegetation strengthening (Parker et al., 2024) a) 2023 b) 2024. (Parker et al, 2024)**

Early experience with cross channel structures resulted in some important learnings, primarily that up- and down- stream bed armouring was needed to avoid unintended bed scour.

The data collected continues to support the premise that the cross-channel structures are efficiently complementing the rock grade control structures. It is noted in this context, that the cross-channel structures will have a finite lifespan defined by the durability of the piles used. The intent is that the cross-channel pile structure provides short-medium term stability while complex riparian revegetation establishes underpinning longer term bank stability.

### *Bank stability - Estimation of erosion and deposition volumes using LiDAR*

Figure 4 provides graphic evidence of the success of the Laidley Creek remediation effort, comparing the impacts of Ex-Tropical Cyclone Alfred flood flows on two nearby reaches, the first remediated; the second yet to be remediated. Supporting the visual evidence of increased bank stability, LiDAR capture is undertaken every two years to monitor changes in channel and bank geomorphology. In addition, as approximately 2 km of the remediation work undertaken to date were funded through a formal nutrient offset investment, more detailed sediment accounting was undertaken along this reach to quantify and verify sediment erosion which was avoided (Figure 5). The works avoid circa 12,000 tonnes of sediment pollution per year; and, importantly, have trapped (resulted in deposition of) an estimated 800 tonnes/yr (Table 1).

**Figure 4 Aerial photos post Cyclone Alfred (March 2025) - Left -2017 stabilised bank, Right - untreated bank**

**Figure 5 LiDAR elevation changes between 2021 and 2018 – Site 1 (changes greater than 30 cm)**

**Table 1 Sediment accounting summary on 2km of stabilised banks Sites 1 to 3 (Change between 2021 and 2018)**

| | Site 1 | Site 2 | Site 3 | TOTAL |
|---|---|---|---|---|
| **Length (m)** | 1120 | 330 | 600 | **2050** |
| **Estimated Sediment loss (m³/m/yr)** | 6.5 | 6.5 | 7.9 | |
| **Estimated Sediment loss (t/yr)** | 6067 | 1788 | 3950 | **11804** |
| **Lidar deposition/Erosion 2018-2021 (t/yr)** | 560 | 12 | 269 | **841** |

A post 2022 flooding assessment on bank stability documents that the remediation works have significantly reduced channel erosion; noting that where erosion has occurred, it is relatively localised and has not significantly compromised bank stability (Ivezich, 2022). The Ivezich (2022) report additionally highlights that while the soft engineering works have provided the design intent of strengthening remediated banks, success in establishing the riparian vegetation, that is critical for longer term resilience to more intense flood events, has been mixed. The learnings from both the success and failures of riparian revegetation establishment have been used to modify practice, such as infill planting at remediated sites.

### *Riparian vegetation establishment*

Native riparian vegetation provides crucial long-term bank stabilisation (Rutherfurd et al, 2000). A large body of research shows that diverse, structurally complex riparian vegetation communities stabilise banks by slowing flows during high flow events. This is achieved by increasing roughness and protecting exposed soil and roots (Tozer et al 2023; Rutherfurd et al, 2000; Ivezich 2022).

Riparian revegetation presents specific challenges such as planting on steep slopes that result in reduced subsoil moisture retention, aggressive weed competition inhibiting desirable species survival and growth, and high increased flood risk during early plant establishment, particularly in lower bank areas (Ivezich 2022). In some cases, access can be difficult when gradients greater than the target 1V:3H cannot be achieved due to the retention of mature native tree species or infrastructure placement restricting safe access.

The following section highlights key learnings with respect to successful riparian vegetation establishment in Laidley Creek.

*Species selection*

Drawing on ten years of vegetation monitoring across rehabilitated sites, revegetation specifications have been refined, including refining species selection, planting densities and timing of planting. For example, the most recent vegetation monitoring data on a two-year-old 550 m long bank reprofiling site, showed that establishment success is greater for certain species (e.g., *Casuarina cunninghamiana*, *Eucalyptus tereticornis* and *Grevillea robusta*, and less successful for others (e.g., *Castanospermum australe*) (Table 2). Although present in the pre-clearing riparian vegetation, species such as *C. australe* appears better suited to planting once canopy cover from pioneer species has been established. These findings inform future project design, with the potential for refining species selection and investigate options for staged planting.

*Focus on lower bank*

Vegetation monitoring identified that lower bank vegetation had lower survival rates (Table 2) than that observed in the upper bank. This is, in part, due to storm flows causing vegetation on the lower bank to be inundated more frequently prior to effective vegetation being able to establish. Evidence for this is shown in Figure 6 where over the past five years, the lower banks of Laidley Creek have been underwater at least twice a year (Figure 6).

**Table 2 Survival rate since planting in November 2023**

| | **Total planted** | **Survival rate 2024 09/07/2024** | **Survival rate 2025 18/08/2025** |
|---|---|---|---|
| **Live trees and shrubs** | 1870 | 81% | 71% |
| **Total number ground species (*Lomandra* sp.)** | 600 | 12% | 2% |
| **Live stems** | 2470 | 65% | 57% |
| **Tree and Shrub Species (**Scientific Name) | | | |
| **Higher and middle bank** | | | |
| *Casuarina cunninghamiana* | 255 | 95% | 95% |
| *Eucalyptus tereticornis* | 417 | 100% | 93% |
| *Grevillea robusta* | 105 | 95% | 95% |
| *Angophora floribunda* | 50 | 0% | 0% |
| *Castanospermum australe* | 100 | 100% | 60% |
| *Corymbia tesselaris* | 100 | 0% | 0% |
| *Toona ciliata* | 38 | 0% | 0% |

| | Total planted | Survival rate 2024 09/07/2024 | Survival rate 2025 18/08/2025 |
|---|---|---|---|
| *Eucalyptus seeana* | 11 | 0% | 0% |
| *Acacia salicina* | 130 | 60% | 50% |
| *Hymenosporum flavum* | 12 | 100% | 100% |
| **Lower bank** | | | |
| *Melaleuca bracteata* | 250 | 86% | 65% |
| *Melaleuca viminalis* | 402 | 61% | 47% |

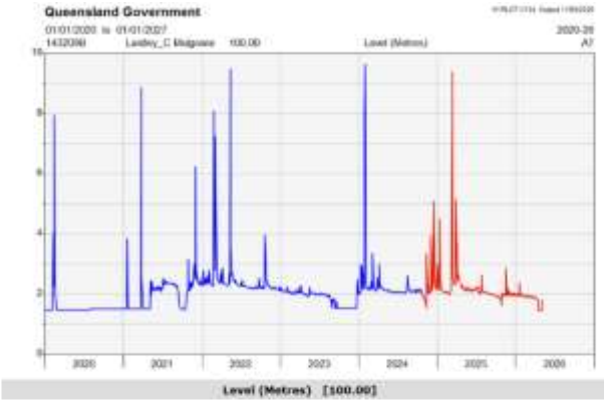


**Figure 6 Water level at Bureau of Meteorology Weather Station 143209B 'Laidley Creek at Mulgowie' Jan 2020– May 2026 (QLD Water Monitoring Information Portal)**

The post 2022 flooding assessment on bank stability recommended that future planting works should have a particular focus on the establishment of dense groundcovers and shrubs along the lower bank with planting density greatly increased in the middle and lower banks (Ivezich 2022). Species such as *Melaleuca bracteata* and *M. viminalis* are now planted in 1.5 m spacing and *Lomandra* spp. in 1 m spacing in the more vulnerable banks. Fluvial scour at the toe is a key determinant of rate of bank erosion and thus it is important to achieve good vegetation cover to reduce flow velocity and bank scour (Rutherfurd et al, 2000).

*Focus on nursery stock quality*

Ivezich (2022) emphasised the importance of rapid early growth in riparian vegetation (to increase early resilience to storm flows), requiring a focus on planting methodologies and stock quality. An important learning for many of the essential tap rooted species, was that commercial nursery practices were resulting in 'J' rooting, which limited rooting success.

Accordingly, planting stock is now procured from local nurseries that have demonstrated a willingness to implement the specified nursery production techniques. This should increase the likelihood of securing quality hardened stock with well developed root systems.

In order to achieve rapid growth and early site dominance of planted nursery stock, trees and shrubs are planted in mega tubes (0.75L) rather than standard tubes (0.2L).

Field observations show that larger stock establishes more rapidly and achieves site dominance sooner than traditional tube stock pots, which is critical in the Laidley catchment where aggressive weeds (e.g. Elephant Grass, Glycine and Castor Oil plant) drive high early maintenance demands.

Directly sourcing plants from local nurseries has greatly contributed to improved establishment rates, with recent planting achieving 98% survival at end of commissioning.

While nursery stock is the lowest-cost component in remediation (Figure 7), plant stock quality has proven a key determinant of success. A further important learning is that quality stock cannot be assumed to be readily available; procurement must be scheduled up to six months in advance to allow appropriate quality-control oversight throughout the growing, development and hardening stages.

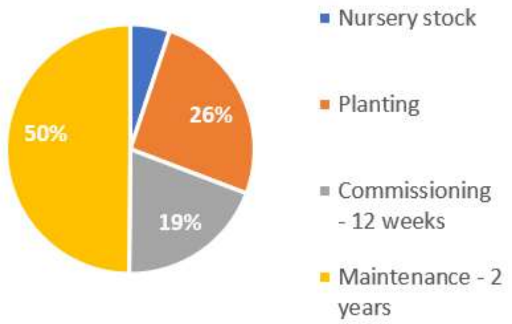


**Figure 7 Latest project Cost - revegetation cost breakdown with two years maintenance**

### *The critical role of landholder engagement in achieving successful outcomes*

Successful project delivery relies on strong landholder support and in-kind contributions, including securing farm access and use of on-farm areas for managing cut in from bank reprofiling. Moreover, works such as bank reprofiling to a 1(V):3(H) slope can require the loss of productive land and/or farm tracks, which poses significant impacts for smaller horticultural operations already under economic pressure (Queensland Fruit & Vegetable Growers, 2026). As works progress upstream and involve additional landholders, establishing a clear economic case for producers will be critical to the long-term viability of the program.

While the remediation work undertaken to date in Laidley Creek may be regionally important, it has identified a specific challenge and highlighted the importance of engagement and quality geomorphic information in securing landowner agreement for works. Specifically, many of the target remediation Reaches have legacy berms (levies) that have reduced flooding of production lands. Not surprisingly, growers demand that these be preserved, and indeed heightened. However, best geomorphologic remediation encourages greater engagement of the floodplain. The compromise adopted in the Laidley Creek works has been to reinstate legacy levies, where they have had to be moved for bank reprofiling, to no greater height than the legacy height; and to establish no new levies. The compromise has been critical to securing landowner approval and support.

## Conclusions

The Laidley Creek remediation program highlights the effectiveness of long-term, catchment-scale approaches to addressing channel instability and sediment loss in intensively managed agricultural landscapes. Monitoring results demonstrate that integrated interventions including reach-scale planning, grade-control structures, bank reprofiling and adaptive revegetation have improved channel stability, while increasing the resilience of important horticultural production areas to flood flows. Riparian revegetation is critical to delivering long-term resilience but remains challenging, particularly on frequently inundated lower banks. Long-term monitoring has enabled refinements to species selection, planting density and staging, while the adoption of direct sourcing of larger nursery stock has improved establishment outcomes, albeit with added scheduling complexity. Strong landholder engagement has been essential to successful delivery to date. However, as works extend upstream, managing trade-offs associated with productive land loss and articulating clear economic benefits for producers will be increasingly important to ensure the long-term viability of the program.


## Acknowledgements

The authors would like to acknowledge and thank the following individuals and organisations for their technical inputs and/or funding: the Port of Brisbane Pty Ltd for financial funding and inputs and particularly the involvement from Craig Wilson and Michael Linde over the years, Misko Ivezich and Tim Ferguson (Alluvium), Tony Constantini, Jess Walker and Julian O'Mara, Nathaniel Parker and Loren Otto (Airborn), fundings from Urban Utilities and Department of the Environment, Tourism, Science, and Innovation (DETSI), Mulgowie Farm Corporation and landholders we have worked with.

## References

Hough, C. (2013, April 9). *Markets keep flood recovery on track*. ABC News. https://www.abc.net.au/news/rural/2013-04-09/markets-keep-flood-recovery-on-track/6258648

Constantini, T. (2022). *Review of Laidley Creek Riparian Restoration – Revegetation Works*. Report prepared for Healthy Land & Water.

Freestone, F. L., Canham, C. A., Setterfield, S. A., Tayer, T. C., Beesley, L. S., & Douglas, M. M. (2026). How can we improve if we don't measure? Evaluation of riparian revegetation projects prevented by lack of monitoring data. *Ecological Management & Restoration* 27, no. 1: e70034.

Grinham, A., Costantini, T. et al. (2024). Nitrogen loading resulting from major floods and sediment resuspension to a large coastal embayment, *Science of the Total Environment*, 918.

Ivezich, M. (2022) *Post-flood assessment of works for PBPL*.

Olley, J., Wilkinson, S., Caitcheon, G., & Read, A. (2006). "Protecting Moreton Bay: How can we reduce sediment and nutrient loads by 50%?" *Proceedings of the River Symposium 2006*, CSIRO Land and Water.

Olley, J. M., Coates-Marnane, J., Orr, D., Heeley, B., & Tsoi, I. (2024). *Temporal changes in catchment sediment and nutrient loads and the influence of riparian forests*. Healthy Land & Water. https://www.researchgate.net/publication/380602821

Parker, N. & Otto, L. (2023) *Laidley Creek, Mulgowie Stabilisation Works Condition Report*. Report prepared for Healthy Land & Water.

Parker, N. & Otto, L. (2024) Laidley Creek*, Mulgowie Stabilisation Works Condition Report*. *December 2024 update (2021–2024 comparison)*. Report prepared for Healthy Land & Water.

Queensland Government. (n.d.) Queensland Water Monitoring Information Portal. https://water-monitoring.information.qld.gov.au/ (Accessed: 11th May 2026).

Queensland Fruit & Vegetable Growers. (2026, March 30). *Enough talk – it's time for action*. https://www.qfvg.com.au/news-room/enough-talk-its-time-for-action

Russell, K. (2023, April 12). *We can do more to restore our freshwater ecosystems*. Pursuit, The University of Melbourne. https://pursuit.unimelb.edu.au/articles/we-can-do-more-to-restore-our-freshwater-ecosystems

Rutherfurd, Ian & Marsh, Nicholas. (2000). *A rehabilitation manual for Australian streams* (Vol. 2). Cooperative Research Centre for Catchment Hydrology.

Tozer, M., Ivezich, M. & Ferguson, T. (2023) *Laidley Creek geomorphic assessment and masterplan – Reach 2 and 3.* Final report prepared for Healthy Land & Water by Alluvium Consulting.