City of Ipswich

Offsite Stormwater Quality Improvement Program

Annual Report 2022-2023

CONTENTS

EXECUTIVE SUMMARY

With an established program such as the Offsite Stormwater Quality Improvement Program (OSQIP) it is important to continuously monitor and evaluate to ensure the program continues to meet its objectives while responding to changing conditions.

To date, council has made excellent progress in meeting its offsite water quality improvement liabilities. Using only 42 per cent of the total funds received, council has been able to achieve between 59 per cent and 200 per cent of its water quality improvement obligations.

Sarah Drive Bioretention Basin (March 2023)

Notwithstanding these successes, there are some ongoing challenges which the program is adapting to.

These include rapidly rising cost of completing offsite projects, pending shortfall in larger cost-efficient project locations to deliver future projects and an effective and funded maintenance program to ensure the water quality improvements gained through the capital investment are retained.

In this regard this program is under continual review as part of an adaptive management approach and this report and the data within it is an important part of that feedback loop.

1. PROGRAM BACKGROUND

The Offsite Stormwater Quality Improvement Program, formerly called the Stormwater Quality Offset Program, first launched in 2012 as a pioneering scheme to deliver coordinated water quality improvements in lieu of developers delivering on-site treatment.

This voluntary scheme is guided by:

- The State Planning Policy (SPP), which mandates that development above certain thresholds achieve load-based pollutant reduction objectives for stormwater quality, and provides opportunity for local governments to adopt locally appropriate alternative solutions; and
- The Ipswich Planning Scheme (2016) which establishes Voluntary Stormwater Quality Offset Payments as an alternative to site-based treatment

An offsite program involves council taking on the responsibility to reduce pollutant loads that otherwise must be achieved onsite by developers, namely Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorus (TP) and Gross Pollutants (GP).

Broadly speaking, the Program involves improving water quality in one location to compensate for the deterioration of water quality at another location due to development activity.

In Ipswich, this involves developers making a voluntary financial contribution to council, which then utilises the revenue to fund projects that achieve an equivalent or greater improvement to water quality within the Local Government Area.

The two primary drivers for council to provide this program are:

- Minimising the proliferation of small-scale stormwater treatment facilities on infill development sites. These privately owned treatment facilities are difficult and costly for council to ensure that they remain functional
- Addressing an issue of poorly designed and constructed stormwater treatment assets which, once inherited from developers, are difficult for council to manage.

The program addresses these management issues by enabling a coordinated approach to the management of stormwater quality.

Implemented strategically, the Program can lead to a net benefit to Ipswich's waterways (compared to developer-led projects) by:

- maximising water quality improvements through a greater variety of projects, types and locations
- leveraging additional funds to increase the scope or size of a project that would otherwise not have been feasible
- providing a broad variety of additional benefits including public amenity and aesthetics, urban greening, increased biodiversity, carbon capture, flood mitigation and waterway health benefits beyond water quality.

In alignment with program's vision, the types of projects undertaken to date are diverse and include creek stabilisation, channel naturalisation, constructed wetlands, floodplain re-engagement, bioretention basins, and rural revegetation and cattle exclusion.

Council has demonstrated success through this program, such as the Small Creek Channel Naturalisation project which has won numerous awards and sets the standard for similar projects across the region.

For the voluntary program to be an option, specific criteria must be met at each stage of the process (See Figure 1).

Figure 1: Overview of how the Program works

New Development Application

Confirm development is eligible to participate in the Program

- Requirement for stormwater quality management threshold exceeded (e.g. 6 or more dwellings)
- Development is within an area eligible to participate in the Program (see eligibility map - Appendix A)
- Council reviews and approves Development Approval for participation in the Program (e.g. assesses against criteria such as ensuring waterway downstream is not sensitive to hydraulic change).

Offsite Delivery Approved

Determine water quality liability and financial contribution

- Value of voluntary payment calculated based on the specified charge rate. ($ per sq m of required bioretention area)
- Bioretention treatment area required is based on the total area of development, density of development and requirement to achieve an 80% TSS, 60% TP, 45% TN and 90% GP load reduction
- Council calculates water quality liability (TSS, TN, TP, GP) based on size of required bioretention area.

Council delivers offsite projects

Council accurately tracks all financial contributions and project delivery

- Council identifies most suitable project types and locations to meet water quality liability
- Water quality improvement calculated using approved stormwater quality modelling (MUSIC) or other methods (e.g. for rural revegetation)
- Project costs assessed to ensure water quality liability is met with available funds
- Council delivers offsite solution. Offsite payments, projects costs, water quality liabilities and achievements are reported.

2. OVERALL PROGRAM STATUS

Summary

As of 30 June 2023, council has expensed 42 per cent of the offsite revenue received (Table 1) and delivered between 59 per cent and 200 per cent of its water quality improvement obligation, with the specific water quality achievement differing between parameters/pollutant types (Table 2).

For example, council has delivered 200 per cent of its TSS and 59 per cent of TN reduction obligations, utilising only 42 per cent of the funds received.

These results highlight the net water quality benefit of the offsite program.

Current FY snapshot

- Current charge rate $510/m2 of required bioretention area
- FY contributions received $4,579,079
- FY funds expended $1,197,094
- FY water quality improvements achieved
  - TSS 49 tonnes/yr
  - TN 134 kg/yr
  - TP 70 kg/yr

Table 1: Program overall financial status at the end of 2022/2023 financial year

	Funds (,000)
Total Revenue	$27,272
Total Funds Expensed*	$11,476
Balance Remaining	$15,796
Percentage of Funds Spent	**42%**

Table 2: Progress toward meeting water quality offsite obligation

	Pollutant Type (kg/yr)			
	TSS	**TP**	**TN**	**GP**
Total Liabilities	458,795	670	2,271	67,322
Total Credit Achieved*	917,938	640	1,340	74,839
Outstanding Liabilities	-459,144	30	931	-7,517
Percentage of Target Met	200%	96%	59%	111%

*Credits are for constructed projects that have achieved practical completion only

Financial contributions and water quality liabilities

The Program has been popular with developers, leading to council collecting in excess of $27 million since December 2014/15.

For each dollar contributed, council incurs a water quality liability for each parameter specified in the SPP which must be delivered at another location. That is, council must reduce the amount of pollutants (TSS, TP, TN & GP) entering Ipswich's waterways by the liable amount (or more).

Between 2014/15 and 2022/23 council acquired a liability to prevent over 458 tonnes/yr of TSS and 2,700 kg/yr of TN from entering Ipswich's waterways with the revenue received (Table 3).

Total contributions in the 2022/23 financial year were over $4.5 million, the largest annual contribution since the program started (Table 3). This was largely due to an anomaly in the Woogaroo Creek catchment where a development made a single large payment for multiple development stages in 2022/23, rather than making smaller annual payments upon completion of each stage.

Table 3: Voluntary contributions made and total water quality liabilities to date

Financial Year	Contributions	Water Quality Liability (kg/yr)			
		TSS	TP	TN	GP
2014/2015	$1,791,188	34,606	51	171	5,078
2015/2016	$3,171,563	58,357	85	289	8,563
2016/2017	$3,114,792	57,312	84	284	8,410
2017/2018	$2,136,638	37,105	54	184	5,445
2018/2019	$3,613,826	60,713	89	300	8,909
2019/2020	$3,092,772	50,318	73	249	7,384
2020/2021	$3,000,790	47,815	70	237	7,016
2021/2022	$2,771,634	43,184	63	214	6,337
2022/2023	$4,579,079	69,387	101	343	10,181
Total	**$27,272,280**	**458,795**	**670**	**2,271**	**67,322**

The greatest water quality improvement has been achieved for Total Suspended Solids (200 per cent) and Gross Pollutants (111 per cent) as seen in Figure 2. The efficiency of the program can be attributed to selecting projects with relatively low cost in relation to the water quality improvements achieved, as well as council's success in leveraging additional funds towards the projects.

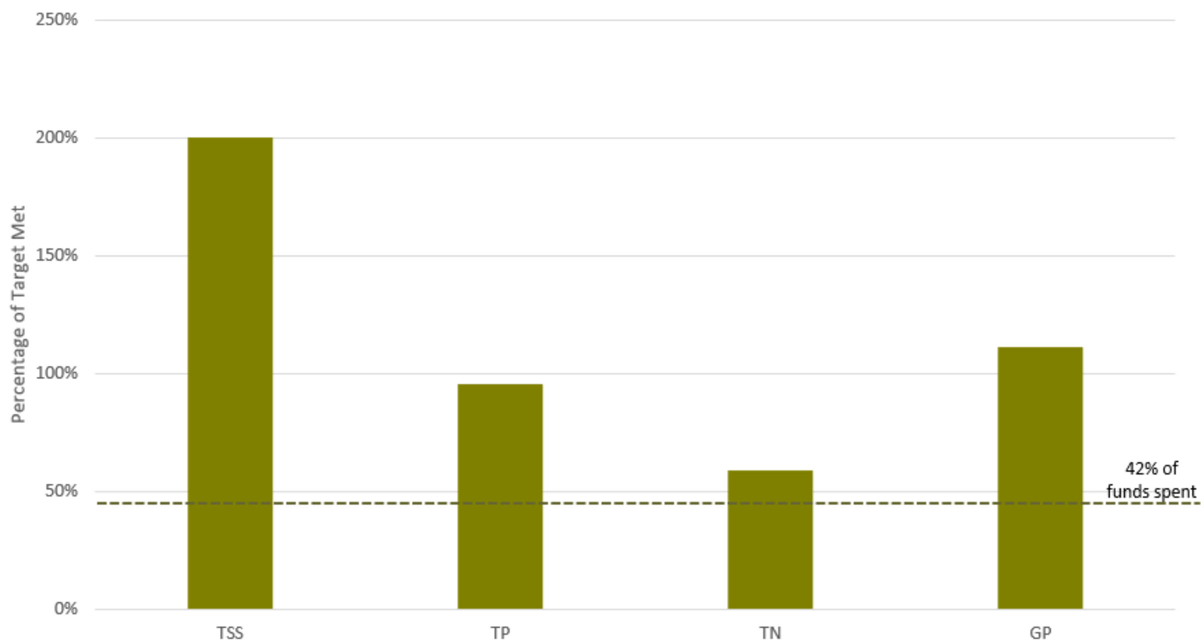


Figure 2: Progress toward meeting council's offsite water quality improvement obligations

Projected offsite demand

To assist in long-term program planning, a projection of offsite demand to 2025/26 has been completed.

The projection is based on the forecasted growth in new housing units, assuming a 50 per cent uptake of offsite within the eligible area.

The forecast was first completed in 2015, and updated in 2020.

Overall, the demand for the Program has been consistent with the forecasted demand, as seen in Figure 3.

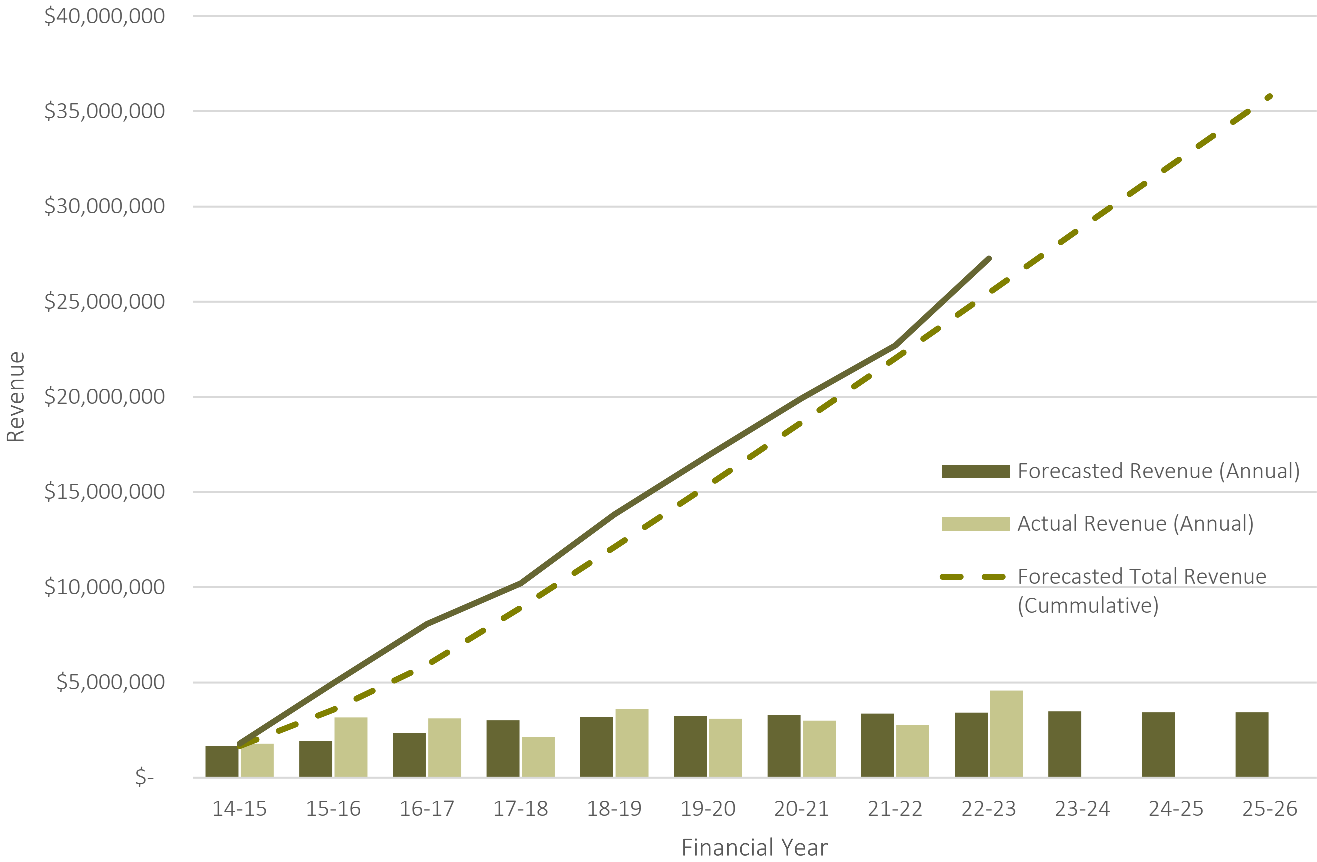


Figure 3: Forecasted versus actual revenue

3. PROJECT DELIVERY STATUS

Summary

To meet Council's water quality liability, nineteen offsite stormwater quality projects have been constructed at thirteen different locations (three locations have multiple stages) as shown in Figure 4.

A diverse range of stormwater treatment methods and project types have been utilised to prevent pollutants entering Ipswich's waterways. These treatment methods and project types include creek stabilisation, channel naturalisation, constructed wetlands, floodplain reengagement, bioretention basins, and rural revegetation and cattle exclusion.

Projects are selected based on several criteria to ensure best outcomes including, not only the required water quality improvements, but other environmental and social benefits such as increased biodiversity and education and awareness.

The key benefits the nineteen projects provide have been summarised in Table 4, however there are many other benefits these projects offer to Council, the community and the environment. Moreover, Appendix B provides a summary of each project, as well as further project details.

Current FY snapshot

In 2022/23, a total of nine offsite solution projects progressed through various design and construction stages, as outlined in Table 4. Of these nine, three projects successfully achieved practical completion within the 2022/23 financial year.

Table 4: Summary of offsite solution projects progressing in 2022/23 financial year.

Stage	Project name	Sub-catchment
Practical Completion	Ironpot Creek Stabilisation (Stage 2)	Ironpot Creek
	Woogaroo Creek Stabilisation (Sites 7 & 9)	Woogaroo Creek
	Franklin Vale Creek Catchment Initiative (Tunnel Erosion Rectification & Stabilisation)	Franklin Vale Creek
Under Construction	Short & Alice Street Water Smart Street Trees	Bundamba Creek
	Schoffield Court Bioretention Basins	Six Mile Creek
	Franklin Vale Creek gully head rectification and revegetation	Franklin Vale Creek
Detailed Design	Harry Ratnam Park Constructed Wetland	Goodna Creek
	Bremervale Park Ephemeral Wetland	Bundamba Creek
	Ironpot Creek Stabilisation (Stage 3a & 3b)	Ironpot Creek

Figure 4: Constructed offsite stormwater quality improvement project locations and treatment method/project type

Table 4: Key benefits of the various offsite stormwater quality improvement projects types

Project Type	Location of Completed Projects	Key Project Benefits
Creek Stabilisation &/or Channel Naturalisation	• Ironpot Creek • Pollard Park • Small Creek • Woogaroo Creek	• Water quality improvement (removes TSS, TN, TP and GP from stormwater & prevents pollutants from being released into local waterways) • Increased biodiversity & habitat improvement • Carbon capture • Infrastructure & property protection
Bioretention Basins/Systems	• Fail Park • Bob Titcombe Park • Sarah Drive Park • Wallaby Ware Park	• Water quality improvement (removes TSS, TN, TP and GP from stormwater) • Increased biodiversity & habitat improvement • Flood storage • Community liveability improvement
Water Smart Street Trees	• Pine Mountain	• Water quality improvement (removes TSS, TN, TP and GP from stormwater) • Street beautification • Community liveability improvement • Urban cooling & improved air quality • Reduced reliance on drinking water supplies
Rural Revegetation, Cattle Exclusion, Tunnel Erosion and Stabilisation	• Franklin Vale Creek	• Water quality improvement (prevents TSS, TN, TP and GP from being released into local waterways) • Increased biodiversity & habitat improvement • Carbon capture
Floodplain Re-Engagement	• Moodai Reserve	• Water quality improvement (removes TSS, TN, TP and GP from stormwater) • Flood storage & reduction • Infrastructure and property protection • Increased biodiversity & habitat improvement
Constructed Wetlands & Stormwater Harvesting	• Jim Donald Parklands • Redbank Plains Recreation Reserve	• Water quality improvement (removes TSS, TN, TP and GP from stormwater) • Flood storage & reduction • Reduced reliance on drinking water supplies • Increased biodiversity & habitat improvement

Project pollutant reductions

The nineteen water quality improvement projects delivered through the Program have effectively reduced pollutant loads entering Ipswich's waterways.

Table 5 outlines the pollutant reduction achievements per project, also known as water quality improvements, that have been attained through the program.

To date these projects have reduced TSS and TN loads by an estimated 917,938kg/yr and 1,340kg/yr, respectively, thus improving water quality in Ipswich's waterways.

The potential water quality improvements that a project can deliver vary greatly and depend on the stormwater treatment method or project type utilised (e.g. bioretention facility vs channel naturalisation), the scale of the project and the size of the associated catchment.

For example, Table 5 shows that the Small Creek Channel Naturalisation project achieved an estimated 131,932kg annual reduction in TSS, while the bioretention facility at Wallaby Ware Park achieved an estimated 3,466kg annual reduction in TSS load.

In 2022/23, all three offsite solutions that reached practical completion were creek stabilisation projects. Creek stabilisation projects are very efficient at reducing sediment entering the waterways. For example, Ironpot Creek Stage 2 Stabilisation Project, completed in 2022/23, was estimated to mitigate over 328 tonnes of sediment entering the waterway. This is over one third of the total sediment reduction the OSQIP has achieved to date.

Table 5: Water quality improvements achieved for completed projects

Project	Sub-catchment	Water Quality Improvement (kg/yr)			
		TSS	TP	TN	GP
Bob Titcombe Park Bioretention Basin	Mihi Creek	6,570	9	36	1,120
Fail Park Bioretention System	Bundamba Creek	3,860	6	21	791
Franklin Vale Creek Catchment Initiative	Bremer River	80,563	139	123	-
Ironpot Creek Stabilisation	Ironpot Creek	417,434	21	100	-
Jim Donald Parklands Constructed Wetland	Bundamba Creek	51,000	79	139	9,540
Moodai Reserve Floodplain Re-engagement	Woogaroo Creek	10,003	12	27	898
Pollard Park Channel Naturalisation & Filtration Basins	Sandy Creek (Camira)	33,100	48	81	9,148
Redbank Plains Recreation Reserve Wetland	Goodna Creek	8,470	23	139	3,890
Sarah Drive Park Bioretention Basin	Bremer River	6,570	11	40	1,070
Small Creek Channel Naturalisation	Deebing Creek	131,932	228	538	47,615
Wallaby Ware Park Bioretention Basin	Ironpot Creek	3,466	5	19	614
Water Smart Street Trees - Biopod Refurbishment	Ironpot Creek	2,270	3	7	153
Woogaroo Creek Bank Stabilisation	Woogaroo Creek	162,700	56	69	
	Total	**917,938**	**640**	**1,340**	**74,839**

Rural revegetation and cattle exclusion can be a highly cost-effective method of achieving the water quality objectives and have broader beneficial outcomes in terms of overall waterway health.

In saying this, limited data exists that can quantify revegetation in terms of the direct improvement to water quality. As such, environmental equivalence with a high level of confidence is difficult to demonstrate.

Additionally, this approach especially when delivered in upstream rural areas, can have a large spatial separation from offsite locations and a temporal lag of up to twenty years whilst the vegetation matures sufficiently for the full benefit in pollutant reductions to be realised.

To account for the temporal lag, the total offsite credits achieved at the project's maturity (assumed to be at 20 years) are prorated equally over this time period. As such, the water quality improvements for the Franklin Vale Creek Project in Table 5 represent only a fraction (~20%) of the final estimated water quality improvement estimate.

When considering the uncertainty associated with rural revegetation, the validity of the use of this method in the program should be regularly reviewed in relation to ongoing and developing research and data in this field.

Notwithstanding, the wider benefits for waterway health are clear and are very high relative to the cost required to undertake these works.

Therefore, to manage the inherit uncertainty and risk associated with these projects, the program sparingly relies on rural revegetation and instead delivers a diverse range of best management practice projects.

Further to this, an uncertainty ratio of 1:1.5 has also been applied to the calculated pollutant reduction values for rural revegetation works, in-line with best practice offsetting procedures, accounting for the spatial separation and inherit uncertainty.

Catchment pollutant reductions

Spatial separation must be considered to adequately reflect on the success of the program and understand environmental equivalence.

That is, the location of where the liability was originally generated (the development site) in relation to where the offsite water quality improvements were achieved (offsite project site).

Achieving spatial equivalence is also identified as best practice in the State Guidance (SPP guidance, 2021), affirming "the location of the offsite solution should benefit the same receiving waters that the development impacts".

Council aims to deliver projects as close to the source as possible (i.e. within the same creek catchment), but also recognises this may not always be feasible, or that there may be a temporal separation when delivering projects leading to a temporary water quality improvement surplus or liability.

On a per catchment basis, an analysis of the net position of the Program has been undertaken by comparing the pollutant reductions achieved in each catchment to the catchment's total liability.

Figures 5 and 6 present the results of this analysis, indicating the catchments in surplus as well as those which still hold water quality liabilities. Where the water quality improvement achieved is greater than the liability, the catchment is shown in a surplus position.

Alternatively, where the achieved pollutant reductions are less than the inherited liability, the catchment is shown in a deficit position. To complement this analysis, the water quality improvements achieved within each catchment have also been specified in Appendix C.

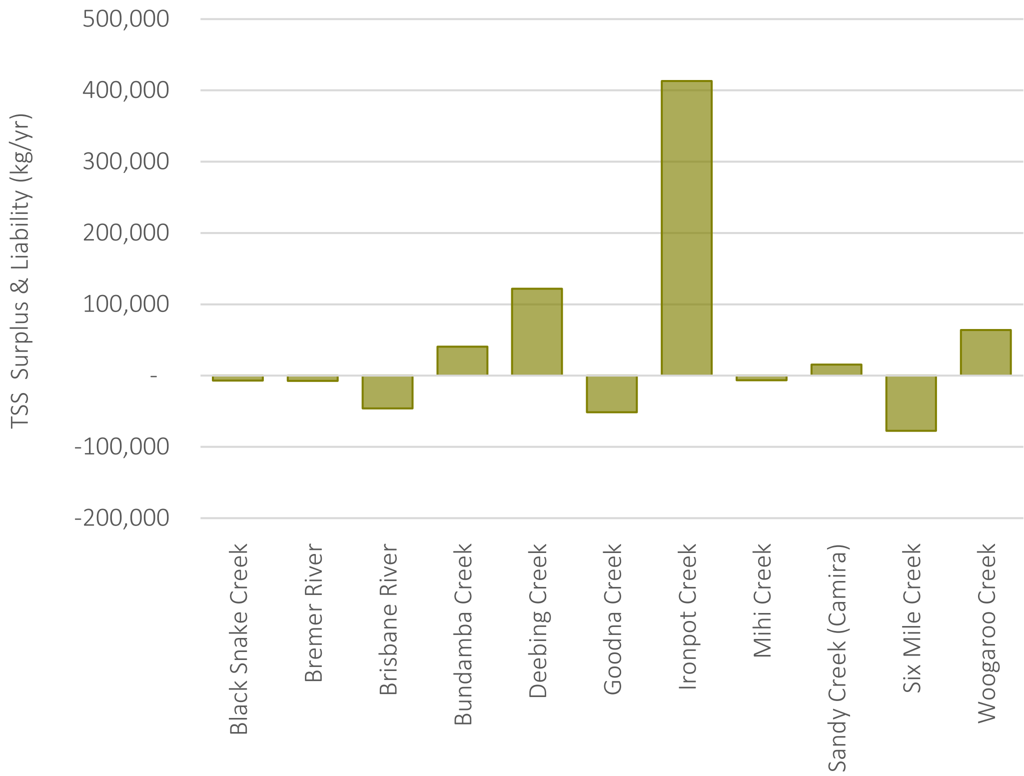


Figure 5: TSS catchment surplus and liability

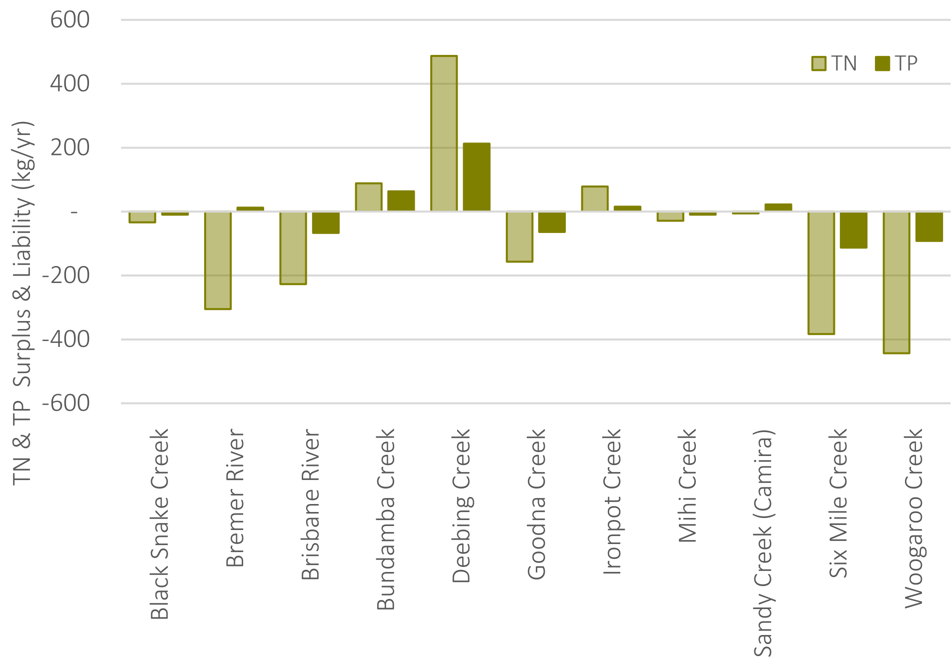


Figure 6: TN and TP catchment surplus and liability

The figures show that council has achieved its water quality improvement obligations in Bundamba, Deebing and Ironpot Creeks, and any further offsite projects in these catchments should be supported by future projected demand in these catchments.

Conversely, many catchments display a net deficit for all water quality parameters (TSS, TP and TN), including Goodna Creek, Six Mile Creek and Woogaroo Creek. This analysis highlights those catchments where council should be focusing the delivery of offsite solutions to help ensure water quality improvements are achieved as close as practical to where council’s obligation (i.e. development) was generated.

Additionally, while projects have not been undertaken in the Brisbane River catchment per se it should be acknowledged that all the rivers and creeks flow into Brisbane River. As such, the Brisbane River is ultimately receiving water quality improvements through projects that are delivered in upstream catchments.

Project expenditure

The total cumulative expenditure for constructed projects as of June 2023 was in order of $14.4M, of which the Program contributed approximately $11.4M while non-offsite funding (e.g. grants, council sub-programs) contributed the remaining $2.9M. This equates to more than 79 per cent of the total project cost being funded by voluntary offsite stormwater quality improvement contributions.

The cost of individual projects varies substantially depending on the scale and complexity of the project, with some projects costing as little as $141,000 (Water Smart Street Trees) and others costing significantly more at over $7 million (Small Creek Naturalisation) (Figure 7). Although there is a large difference in costs between projects, all projects are assessed to ensure they are cost effective with regards to providing the required water quality improvement.

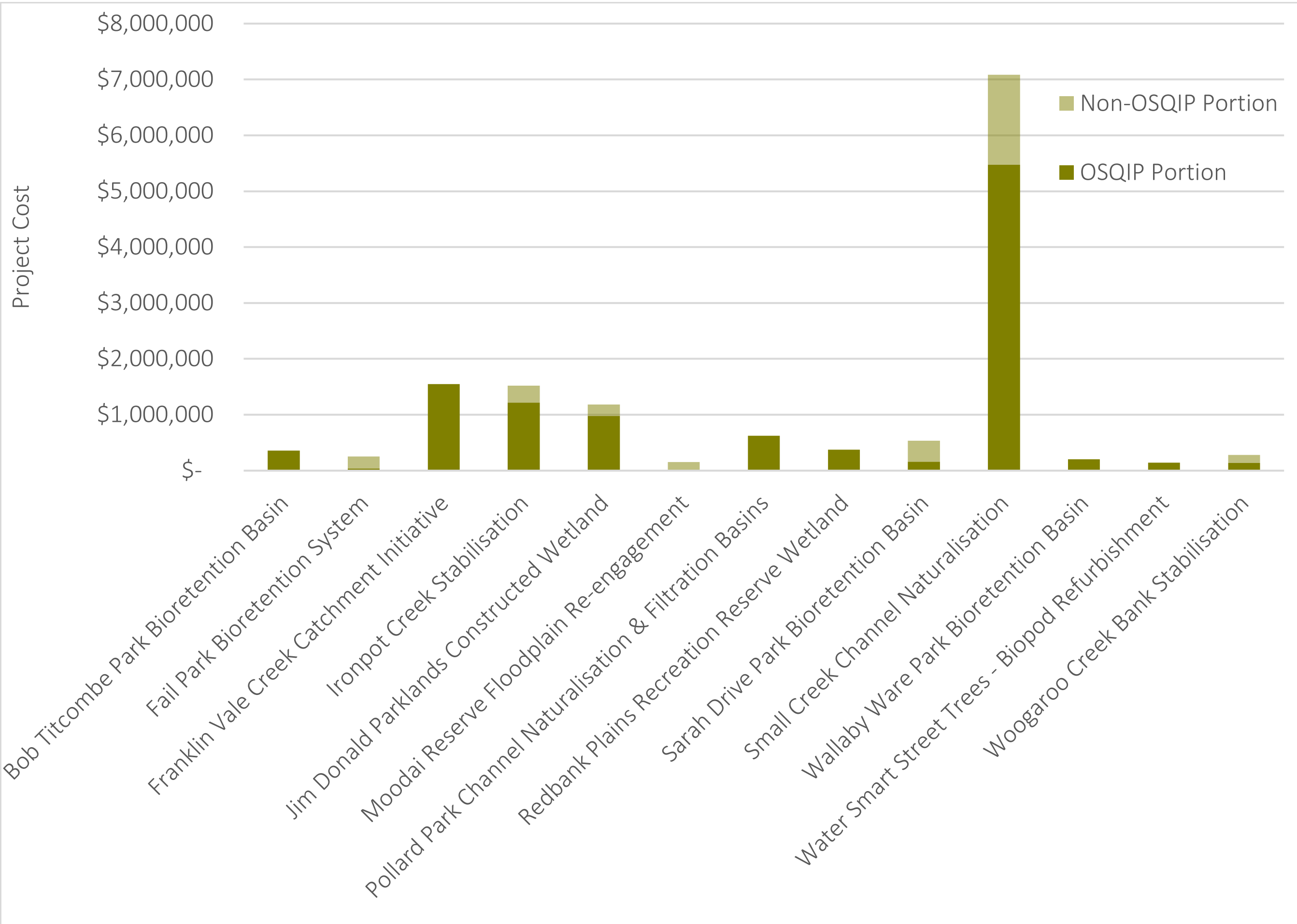


Figure 7: Total expenses for each of the constructed offsite stormwater quality improvement projects.

The proportion of offsite revenue applied varied greatly between projects. For instance, the Program funded four per cent of the Moodai Reserve project, but 100 per cent of the Pollard Park project. When additional funds are from non-offsetting/non-offsite sources, all the pollutant reductions (TSS, TP, TN and GP) achieved by the projects were credited towards council's offsite liability.

Figure 8 shows a breakdown of cost based on stormwater treatment method or project type. It indicates that more than 50 per cent of expenditures have been allocated to channel naturalisation projects. It also shows that funds have been expended relatively evenly between biorientation basins and constructed wetlands, which are relatively common and typical stormwater treatment devices in South-East Queensland.

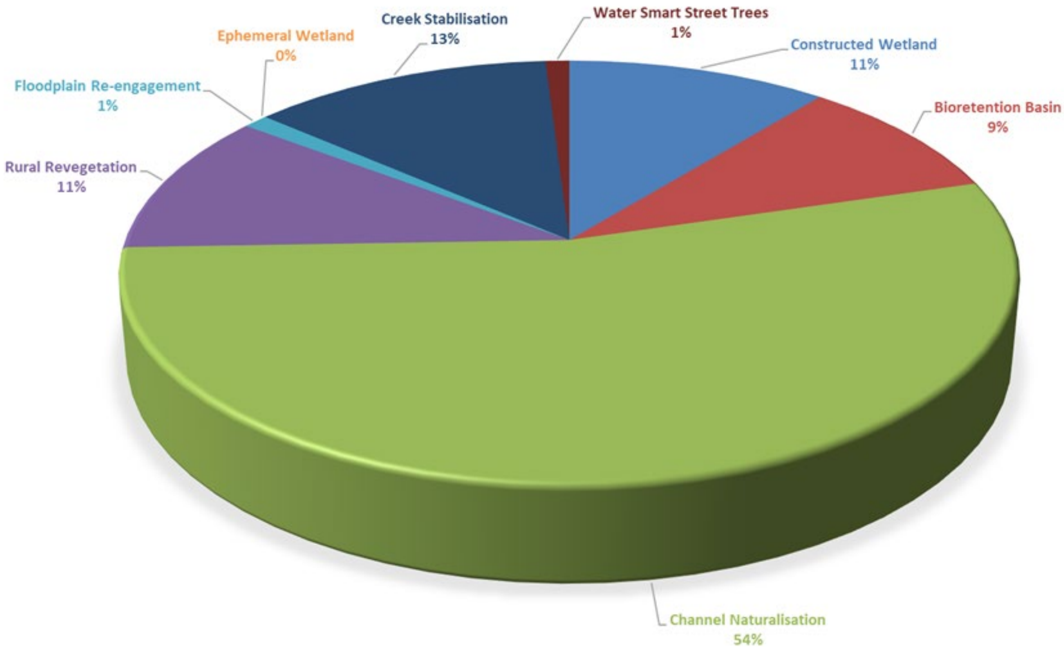


Figure 8: Expenditures according to primary project type

Project cost-benefit assessment

Analysis of project cost in relation to the water quality improvements gained helps ensure the program continues to implement the most cost-effective solutions and adapt as necessary.

While cost-benefit analysis is based on water quality improvements gained, as is the objective of Program, the importance of multiple additional social, environment and economic co-benefits should not be undervalued and should continue to play an important role in project selection.

The cost-benefit assessment of constructed water quality improvement projects, presented in Figure 9, show a wide range of cost efficiencies that vary between project types and the water quality parameters.

- For TSS, the cost-benefit ranged from $2 to $82 per kg of TSS removed, with the Woogaroo Creek project being the most cost effective and the Sarah Drive Bioretention Basin being the least cost effective.
- For TN, the cost-benefit ranged from approximately $2,600 to $19,782 per kg of TN removed, with the Redbank Plains Recreation Reserve Wetland project being the most cost effective and the Water Smart Street Tree project being the least cost effective.

It is important to note that the cost of implementing new types of projects, such as the Water Smart Street Trees, is often higher due to inherent inefficiencies of piloting new methods. Therefore, the cost of such projects is expected to decline as they are further integrated into standard practice.

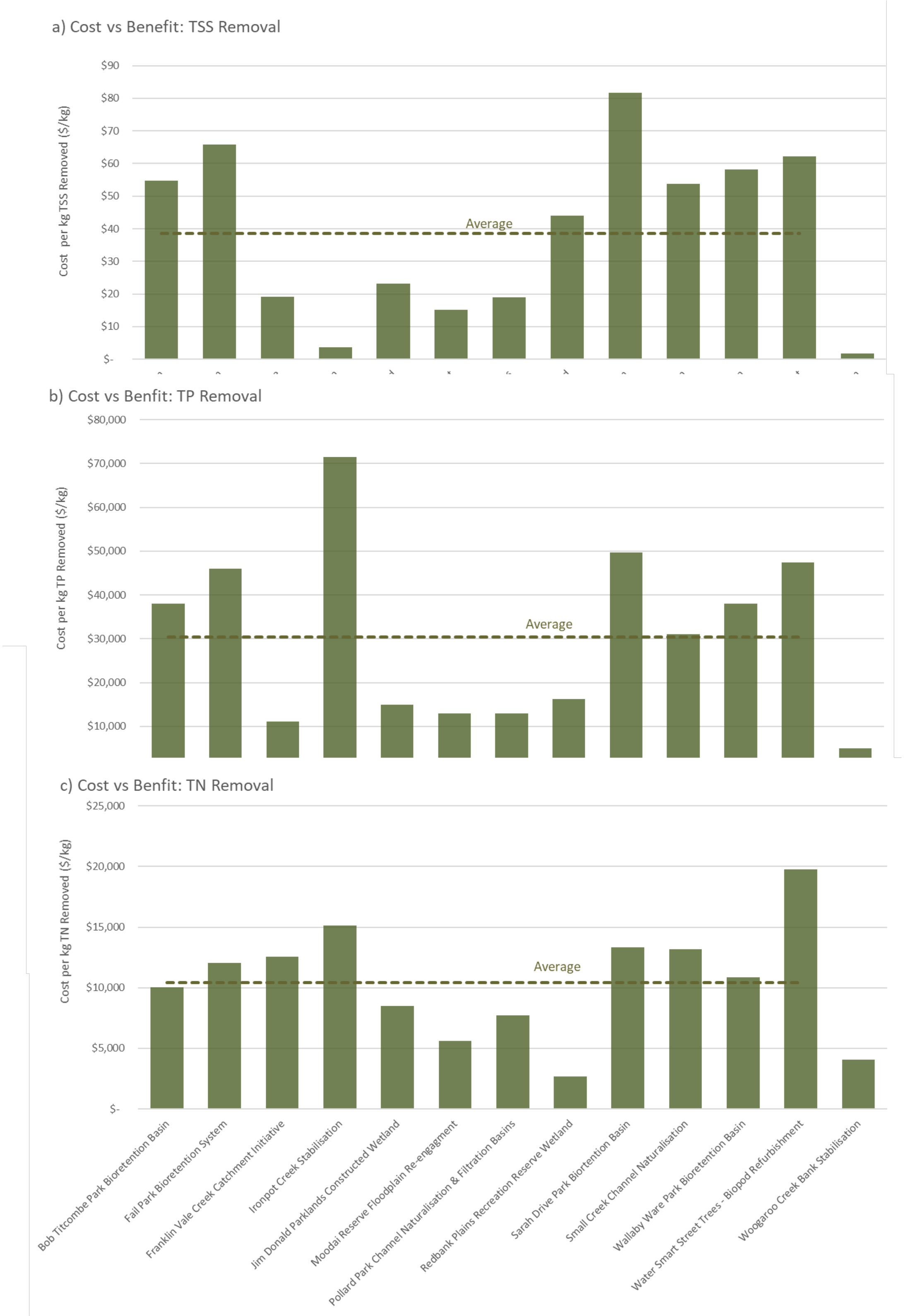


Figure 9: Cost-benefit analysis of completed projects

4. FUTURE DIRECTION

The 2021/22 Program Annual Report discussed the future direction of the program, and made the following observations:

- There is a continuing role for the program based on the benefit it provides, however numerous improvements are needed to ensure council can continue to effectively deliver the program within the available funds while also maintaining high water quality and other environmental outcomes.
- Council needs to adapt to the declining supply of cost-effective project opportunities. This may involve a combination of increasing the developer charge and delivering smaller decentralised offsite solutions.
- Ensuring council is adequately maintaining the offsite projects and building towards a more mature assets systems management approach in support of this.
- The need for a performance monitoring program, whereby monitored sediment and nutrient removal efficiencies for all water quality improvement project types can be compared to literature values that underpin water quality modelling calculations.
- Update the guidelines used by developers to determine eligibility to participate in the program. Release these guidelines with the new Planning Scheme.

Since identifying these required future changes to the Program, council have been developing strategic documentation to guide future improvements, including:

- Internal policy that provides council's strategic position on the Program.
- Internal procedural document that ensures consistent program delivery, particularly in relation to developer eligibility, developer fees and council delivery of offsite solutions.
- A review of the developer fee component, identifying council's cost to deliver the program and whether the fee needs to be adjusted.
- New guidelines that will establish clear eligibility criteria for developers, the method used to determine offsite water quality improvement obligations, and the associated fee structure.
- Creation of a delivery plan for council improvements to inherited assets in conformity with the new policy and procedure.

5. CONCLUSION

The Offsite Stormwater Quality Improvement Program has achieved a high level of efficiency of pollutant removal per dollar spent to date, highlighting the potential of such a program to deliver additional benefits.

The nineteen constructed projects, either completely or partially funded by the Program, have collectively contributed toward achieving council's pollutant reduction obligations, achieving at minimum a 59 per cent reduction in total liabilities accrued through the scheme.

However, some liabilities are yet to be met, and with increasing difficulty projected to achieve environmental equivalence cost effectively, council is actively looking to adapt program delivery and is recommending changes to the eligibility criteria.

The program has enabled a holistic view of stormwater and waterway management, delivering multiple benefits to council and the community that transcend water quality outcomes.

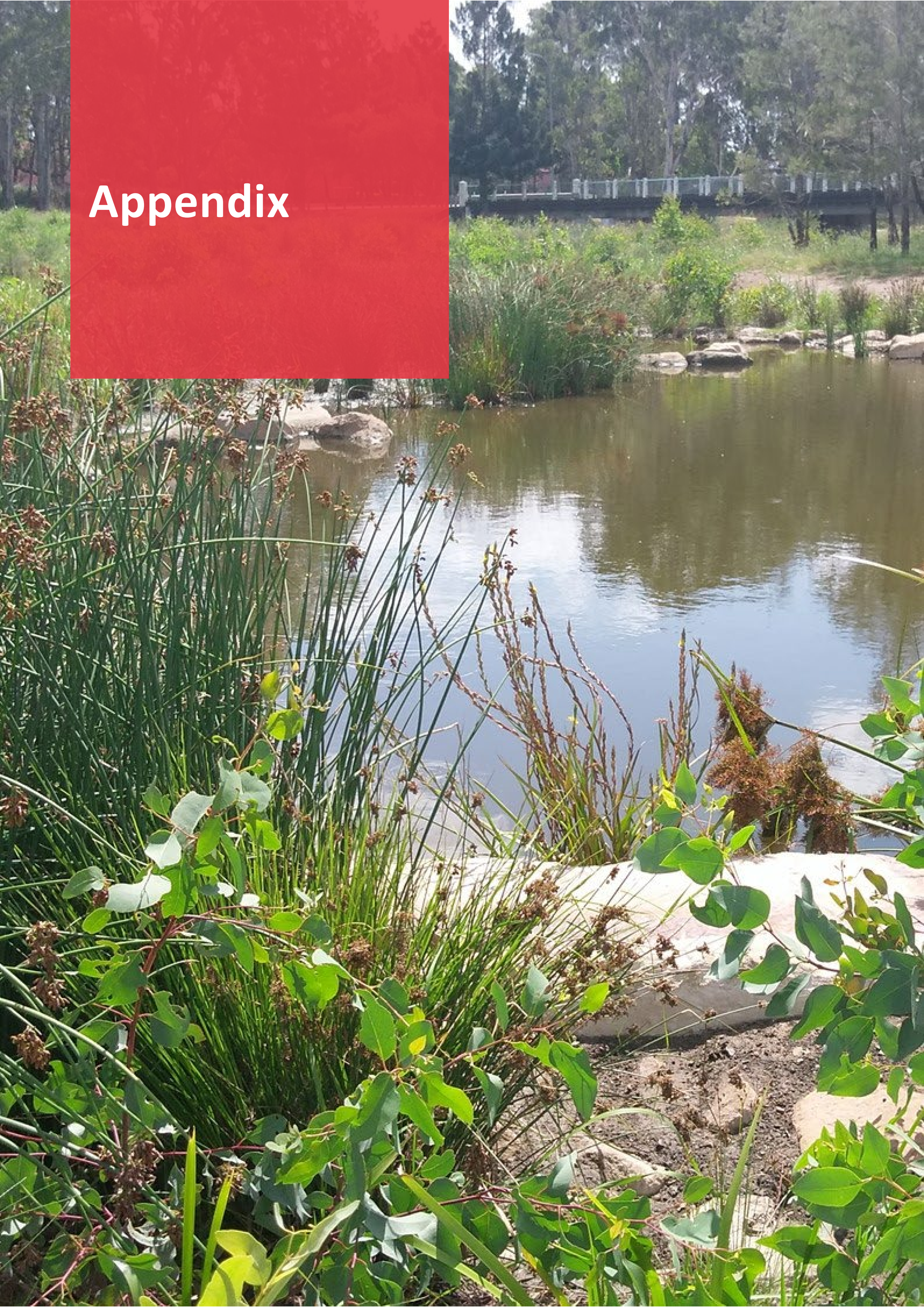
The high calibre of council projects has been recognised through numerous awards and commendations from industry bodies including Stormwater Queensland, the Australian Institute of Landscape Architects, the River Basin Management Society, Healthy Land and Water and the Minister's Urban Design Awards.

The Program is at a level of maturity that makes it appropriate and necessary to progressively undertake improvements and optimise the program moving forwards.

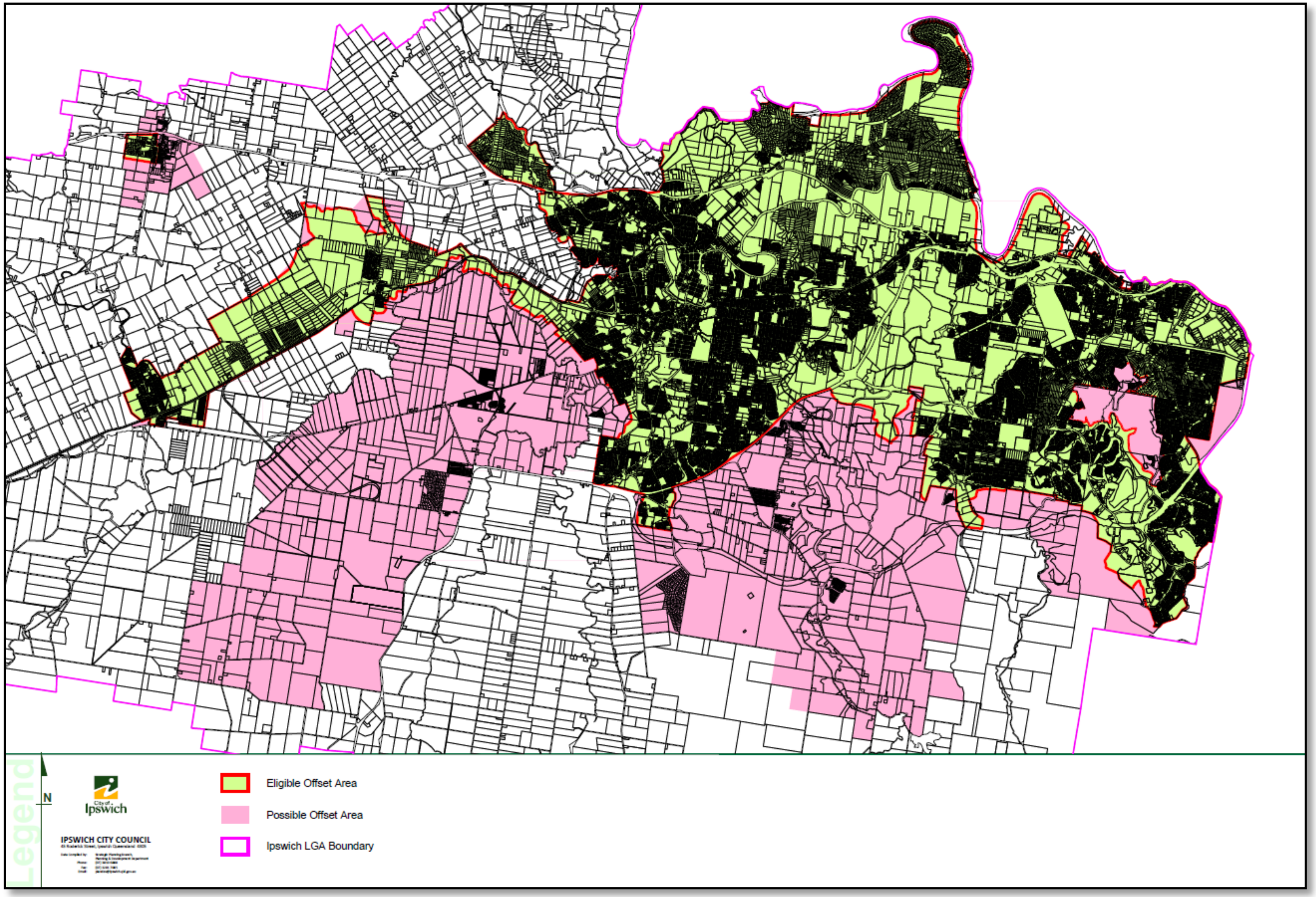
The Program review and subsequent feasibility assessment is a huge first step towards the continuation of excellent delivery, whilst acknowledging the finite number of cost-effective delivery sites requires shift in strategy.

While some challenges have been identified, these can be overcome to continue to effectively discharge the obligations accrued under the program in a responsible manner.

Appendix



APPENDIX A: OFFSITE ELIGIBILITY MAP



APPENDIX B: PROJECT SUMMARIES

Please see the following pages for summaries of existing Council Offsite Stormwater Quality Improvement projects

- Ironpot Creek Stabilisation – Stages 0, 1 & 2
- Wallaby Ware Park, Brassall
- Pollard Park Channel Naturalisation & Filtration Basins
- Small Creek Channel Naturalisation – Stages 1, 2 & 3
- Jim Donald Parkland Constructed Wetland
- Redbank Plains Recreation Reserve Wetland
- Fail Park Bioretention System
- Bob Titcombe Park Bioretention Basin
- Sarah Drive Park Bioretention Basin
- Moodai Reserve Floodplain Re-engagement
- Water Smart Street Trees – Biopod Refurbishment
- Franklin Vale Creek Catchment Initiative
- Woogaroo Creek Stabilisation (Sites 7 & 9)

Ironpot Creek Stabilisation – Stages 0, 1 & 2

Location: Walter Zimmerman Park, Pine Mountain

Catchment: Ironpot Creek

Works: Construction of rock chute to stabilise a rapidly eroding head cut.

Cost: $1,521,757

Pollutants reductions:

- TSS - 328,664kg/yr
- TN - 65kg/yr
- TP - 14kg/yr

Site Context:

Ironpot Creek is a rapidly eroding waterway in the Bremer River Catchment.

The upper catchment has experienced severe degradation in the years since development in the early 1990's. Some of this disturbance may have been instigated off the back of clearing and the construction of the original Brisbane Valley railway line, however a commencement date has been difficult to determine.

Despite retaining a high level of vegetative cover, once the topsoil horizons were disturbed, flows have been able to come into contact with the dispersive sub soils, instigating the process of rapid waterway incision and instability.

Following urban development around the waterway increases in runoff volume and concentration of runoff instigated a second wave of erosion. This rapid erosion is now threatening properties and is requiring stabilisation.

Project Details:

Alluvium Consulting were commissioned to assist Council to determine a stabilisation strategy that worked with natural processes to provide improved stability of the waterway, which was threatening properties and providing a major sediment source to the downstream waterways. The strategy was prepared for an approximately 3km length of the creek in the upper catchment, with a sub-catchment area of approximately 2.2km^2.

The strategy divided this section of the creek into three reaches and provided management options for each. Three separate creek stabilisation projects have now been completed in the strategy area, with the largest project (Stage 2) being completed in 2022/23.

The projects have incorporated a range of approaches to reduce erosion rates including;

i. Reducing the grade of overly steepened sections of the waterway through construction of key bed control structures. These structures were designed to reduce the stream power and erosion potential behind the structure, while managing increased velocities over a hardened portion of the waterway. This approach will ultimately result in bed raising, decreasing susceptibility of head cut, bed incision and increasing instability of the waterway.
ii. Bank reprofiling - large vertical unstable banks have been battered back to a stable 1:3 grade.
iii. Revegetation

A Hec-Ras model was developed including key structures and erosion potential both pre and post intervention were determined. The difference between the two represented the pollutant abatement achieved through the works.

Soil samples were taken to determine the fine particle (suspended) fraction of sediment (ie TSS) and the amount of TN and TP in the soil sample. This allowed a calculation of pollution abatement following the works.

Ironpot Creek Stages 2, stabilising actively eroding gullies

Wallaby Ware Park Bioretention Basin

Location: Wallaby Ware Park, Brassall

Catchment: Ironpot Creek

Treatment type: Construction of vegetated channel and stormwater bioretention basin

Cost: $201,900

Pollutant reductions:

- TSS – 3,466kg/yr
- TN – 19kg/yr
- TP – 5kg/yr

Site Context:

Ironpot Creek is a tributary of the Bremer River. Its upper reaches are severely eroded, while the lower reaches have suffered channel incision with subsequent instability problems.

An open channel flowed through Wallaby Ware Park that was overly steep and subject to consistent erosion.

Project Details:

The channel grade was reduced whilst the capacity increased to a 1% AEP event.

A bioretention basin was constructed inclusive of a saturated zone with temporarily elevated water level. This is intended to provide moisture to the root zones in dry weather periods.

Post establishment, the permanent water level can be reduced to a lower permanent pool depth to eliminate any concerns relating to nutrient leaching, whilst still providing moisture to the root zone via wicking.

Lessons learned:

Pinning jute mat in filter media with is problematic when underlain by thick sugar cane mulch. This causes the matting and mulch to lift during rain events, and smothers tube stock when waters recede. The resulting loss of vegetation set the system back about 12 months.

Headwall and channel prior to works being undertaken

Channel and filtration basin 12 months post work completion

Pollard Park Channel Naturalisation & Filtration Basins

Location: Pollard Park, Camira

Catchment: Sandy Creek (Upper Brisbane River)

Treatment Type: Channel naturalisation & filtration basins

Cost: $624,737

Pollutants Removed:

- TSS – 33,100kg/yr
- TN – 81kg/yr
- TP – 48kg/yr

Site Context:

An overland flow path in Pollard Park had an extensive history of erosion and rectification by Council maintenance crews. The soils are sandy, and a large head cut is prone to forming.

In addition to conveying a 120Ha external catchment, a number of local stormwater pipes enter the park.

Project Details:

Stormwater filtration basins have been constructed using the low nutrient in-situ sandy soils. These have been modelled as bioretention basins in MUSIC using low hydraulic conductivity values that accord with soil testing undertaken.

The channel has been re-constructed to a reduced grade with additional capacity, incorporating additional aquatic macrophytes and trees, rock pool and riffle sequences.

These assist to reduce the stream power in the waterway below a critical level above which erosion is likely to be a feature of the waterway.

Erosion problems prevalent in Pollard Park pre-works contributing to elevated sediment and nutrient exports from the site

Pollard Park post channel naturalisation works completion

Small Creek Channel Naturalisation – Stages 1, 2 & 3

Location: Briggs Road, Raceview

Catchment: Deebing Creek

Treatment Type: Channel naturalisation

Cost: $7,085,456

Pollutants Removed:

- TSS – 131,932kg/yr
- TN – 538kg/yr
- TP – 228kg/yr

Site Context:

Small Creek was once a meandering stream characterised by a chain of ponds.

It was modified in the early 1980's to be straightened and concreted, to improve the efficiency of the channel and move water quickly out of the waterway corridor.

This also eliminated valuable ecosystem services in terms of water filtration, air cleansing and ambient air temperature reduction.

Project Details:

Through the offsite program, Council had a unique opportunity to naturalise Small Creek, turning from a concrete channel back into a living waterway.

The project promotes groundwater recharge, recreates habitat for both terrestrial and aquatic fauna and flora and improves water quality.

Importantly it has represented the desires of the community and provided opportunities to improve amenity and engage the community in the waterway.

The project was undertaken in three stages, resulting in over 1.2km of channel being naturalised between Warwick Road and Poplar Street Park.

The meandering naturalised creek comprises low flow channels, riffles, some larger ponds and rock chute grade control structures. Over 198,00 plants we installed throughout the project.

Sustainability was a major theme of the project and visitors to the new-look Small Creek can see the clever way sections of the concrete channel have been broken up and repurposed in place of rock to eliminate the need for the old channel to be sent to landfill.

Wildlife continues to move back into the waterway, with a variety of water birds, water bugs and fish being sighted.

Small Creek pre-naturalisation

Project Learnings:

The conceptualisation of Small Creek involved a unique co-design process, inviting the community and other stakeholders to have a say in how Small Creek would look, on site at Poplar St Park, Raceview.

It generated ideas and aspirations, concerns and realities of maintaining the new creek. It bundled concept design and consultation into a seamless process that improved efficiency, provided transparency, was robust and rapid.

The process was cheaper and faster than a conventional concept design process and engaged the community in the project from early in the project.

Additional stakeholders such as teachers and students of Bremer State High School and Traditional Owners were also engaged in the project.

Awards:

- Winner - National Landscape Award for Land Management, Australian Institute of Landscape Architects
- Winner - Excellence in Strategic or Master Planning, Stormwater Queensland
- Winner - Queensland State Award of Excellence for Land Management, Australian Institute of Landscape Architects
- Finalists - Government Stewardship, Healthy Land and Water Awards
- Finalist - River Basin Management Society – Involving Community in Waterway Management
- Commendation - Minister's Urban Design Awards

Downstream reach of Small Creek soon after completion

Downstream reach of Small Creek after plants established (November 2022)

Jim Donald Parkland Constructed Wetland

Location: 22 Madden St, Silkstone

Catchment: Bundamba Creek

Treatment Type: Constructed wetland and stormwater harvesting

Cost: $1,181,015

Pollutants Removed:

- TSS – 51,000 kg/yr
- TN – 139 kg/yr
- TP – 79 kg/yr

Site Context:

Jim Donald Park contains two overland flow paths draining the suburbs of Eastern Heights and Newtown.

The flowpaths are boggy and weed riddled with a consistent baseflow. A mixed commercial, residential, parkland and sporting field development has occurred adjacent to the site.

Project Details:

A constructed wetland has been designed and built to treat stormwater from the contributing catchment.

The wetland is offline from the major flow path, to protect it from high flows and sediment.

In addition to the treatment functionality provided by the constructed wetland, a solar harvesting installation has been provided to irrigate the new playing fields, reducing Council's demand on potable water, diversifying supply in times of drought and enhancing amenity and wildlife habitat for the parkland.

The wetland was a first stage of a larger master plan for the parkland.

Lessons Learned:

Planting density should be higher in the channel and around the wetland periphery to improve shading and suppress weed growth. Shade trees should be provided closer to the permanent pool level.

Building phase development needs to be closely managed to ensure compliance with sediment and erosion control measures.

Awards:

- Winner – Excellence in Integrated Stormwater Design, Stormwater Queensland

Jim Donald Parkland wetland

Redbank Plains Recreation Reserve Wetland

Location: Redbank Plains Recreation Reserve – 100 Cedar Road Redbank Plains

Catchment: Goodna Creek

Treatment Type: Constructed Wetland and stormwater harvesting

Cost: $373,547

Pollutants Removed:

- TSS – 8,470 kg/yr
- TN – 139 kg/yr
- TP – 23 kg/yr

Site Context:

The Redbank Plains Recreation Reserve sits within the suburb of Redbank Plains, a developing catchment with a lot of infill medium density development occurring.

It adjoins (and treats) the newly expanded Redbank Plains Road and shopping centre.

Project Details:

This integrated project was constructed in conjunction with the widening and duplication of the Redbank Plains Road project.

It includes detention functionality to reduce flooding in the local area in addition to containing a constructed wetland for water quality treatment prior to harvesting stormwater for irrigation of the sports fields.

The harvesting pump is powered by solar energy and reduces Council's demand on potable water whilst enhancing amenity and wildlife habitat for the parkland.

Lessons Learned:

This project was able to achieve a very high efficiency per dollar spent owing to coupling it with a major infrastructure project, which allowed economies of scale to be achieved.

Birds have proved to be a challenge over the site, reducing the vegetation cover. An appropriate bird management regime is yet to be discovered.

Awards:

- Highly Commended – Excellence in Stormwater Infrastructure, Stormwater Queensland

Redbank Plains Wetland and detention basin

Fail Park Bioretention System

Location: Fail Park – 60 Gledson Street, North Booval

Catchment: Bundamba Creek catchment

Treatment Type: Bioretention Basin

Cost: $254,169

Pollutants Removed:

- TSS – 3,860 kg/yr
- TN – 21.1 kg/yr
- TP – 5.5 kg/yr

Site Context:

The Fail Park sits within the suburb of North Booval, located downstream of an existing 750mm diameter pipe and headwall.

The fully developed external catchment is 6 hectares and comprised of medium to low density residential land use.

Project Details:

This project was constructed as a water quality improvement system providing a suite of benefits for the greater community as well as the area's receiving environments and waterways.

It provides water quality treatment of the connected residential catchment prior to discharging into the receiving environment.

The system integrates with the existing park landscape through the extension of riparian planting which respond to existing topography.

It provides a large and diverse landscape feature incorporating vegetated swales, bioretention basins, rock chutes and overflow control weirs.

Fail Park site in 2020

Fail Park Bioretention Basin Project – October 2022

Bob Titcombe Park Bioretention Basin

Location: 28 A Glenelg Drive, Brassall

Catchment: Mihi Creek catchment

Treatment Type: Bioretention Basin

Cost: $359,875

Pollutants Removed:

- TSS – 6,570 kg/yr
- TN – 35.8 kg/yr
- TP – 9.46 kg/yr

Site Context:

The project site is located downstream of an existing grated stormwater structure with 3x750mm diameter pipes and headwall.

The existing channel was unstable due to upstream urbanisation.

The fully developed external catchment is 8.5 hectares and comprised medium to low density residential land use.

Project Details:

This project was constructed as a water quality improvement system providing a suite of benefits for the greater community as well as the area's receiving environments and waterways.

An objective of this project is to restore some of the connectivity by reinstating a vegetated channel including addressing existing scour points to protect the stormwater treatment asset and existing vegetation.

The system includes an inlet pond, offline bioretention, minor channel reprofiling and scour remediation downstream from the proposed bioretention system.

Bob Titcombe Park, Brassall – 2020

Bob Titcombe Park Bioretention Basin – December 2022

Sarah Drive Park Bioretention Basin

Sarah Drive Park Bioretention Basin during final stages of construction

Location: Sarah Drive Park, Yamanto

Catchment: Bremer River

Treatment Type: Bioretention Basin

Cost: $537,132

Pollutants Removed:

- TSS – 6,570 kg/yr
- TN – 40.3 kg/yr
- TP – 10.8 kg/yr

Site Context:

The Sarah Drive Park is located on the corner of Sarah Drive and Jacaranda Drive in Yamanto.

The adjoining catchment is stable and is classified as low-density residential use.

The existing drainage channel was highly modified and densely vegetated with Typha and eventually discharges to the Bremer river.

Project Details:

This was project constructed as a water quality improvement system providing a suite of benefits for the greater community as well as the area's receiving environments and waterways.

The design for this park has been an opportunity to enhance the amenity of the park through native vegetation and nature-based passive education.

The system includes an inlet pond to capture sediment and deliver flows evenly to the bioretention system.

Sarah Drive Park Bioretention Basin – post construction (December 2022)

Moodai Reserve Floodplain Re-engagement

Location: Moodai Reserve – 269 Jones Road, Bellbird Park

Catchment: Woogaroo Creek catchment

Treatment Type: Floodplain Re-engagement

Cost: $151,975

Pollutants Removed:

- TSS – 10,003 kg/yr
- TN – 27. kg/yr
- TP – 11.7 kg/yr

Site Context:

The project site is an existing Melaleuca forest with an area of approximately 5000m2.

The site is an undeveloped reserve and is bound by Jones Road to the North-West, and a trafficable maintenance track to the remaining perimeter.

The Melaleuca forest was once a natural floodplain/ephemeral wetland whose water sources were cut off when the area was developed and the channel and maintenance track formalised.

Without this water source the health of the vegetation was slowly declining and habitat disappearing.

An external catchment of approximately 98.6 hectares drains through the site via two open vegetated channels.

The majority of the catchment is developed with a range of low-medium density housing and open space.

Project Details:

This project was constructed as a water quality improvement system providing a suite of benefits for the greater community as well as the area's receiving environments and waterways.

The completed works included four rock weirs and a rock spillway within the existing drainage channel, and excavation to reduce the height of the existing maintenance track.

These works re-introduced stormwater into the existing Melaleuca forest (i.e. re-engaged the existing floodplain/wetland) where it will be slowed and filtered through natural processes that once occurred, improving water quality in the catchment.

Reconstructed weir at Moodai Reserve – December 2022

Moodai Reserve showing re-engaged floodplain – December 2022

Water Smart Street Trees – Biopod Refurbishment

Location: Pine Mountain – Shilou Court, Chestnut Drive, Josette Place and Senna Close

Catchment: Ironpot Creek

Treatment Type: Water Smart Street Trees (36 biopods)

Cost: $141,242

Pollutants Removed:

- TSS – 2,268 kg/yr
- TN – 7.67 kg/yr
- TP – 3 kg/yr

Site Context:

Water Smart Street Trees are an innovative way of using stormwater to nourish street trees while also improving water quality.

The system works by diverting stormwater runoff from the kerb into biopods, where the water filters to the root zone.

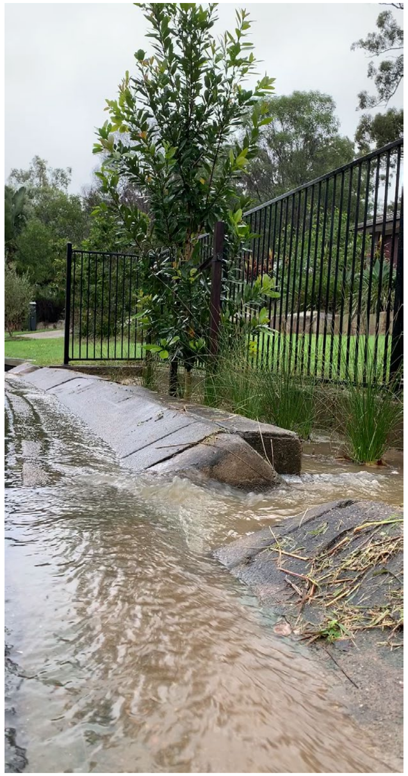
The initiative has multiple benefits, from reducing water usage through to removing pollutant loads from our waterways.

Project Details:

The project consisted of rectifying 36 abandoned biopopds and planting them with a variety of native tree species including *Eleocarpus reticulatus* (Blueberry Ash*), Buckinghamia celsissima* (Ivory Curl), *Alectryon coriaceus* (Beach Bird's Eye) and *Tristaniopsis laurina* 'Lucious' (Water Gum) with *Ficinia nodosa* as the groundcover.

A condition assessment was conducted prior to the planting stage to ensure the existing filter media and stormwater infiltration could still provide the required stormwater treatment function.

The residents immediately impacted by these works were notified face to face and provided a factsheet regarding the benefits.



Water Smart Street Tree in June 2021 soon after planting (left).

Water Smart Street Tree capturing water after rain event in May 2022 (right)

Franklin Vale Creek Catchment Initiative

Location: Franklin Vale Creek

Catchment: Bremer River

Works: Revegetation, cattle exclusion fencing, creek stabilisation

Cost: $1,549,153

Pollutants reductions (In reporting year):

- TSS – 80,563 kg/yr
- TN – 123 kg/yr
- TP – 139 kg/yr

(Note: Total project reduction is prorated over 20-year period, values report here represent approximately 20 per cent of estimated final pollutant abatement)

Site Context:

Franklin Vale Creek flows into Western creek at Calvert before flowing into the Bremer River south of Rosewood.

A history of clearing in the catchment has left parts of Franklin Vale Creek and the waterways that feed into it with instability and bank erosion that impact on water quality and the values of the creek itself.

This in turn negatively impacts the productivity of graziers that depend on the creek for watering livestock and to the wildlife that depend on these productive lands.

Project Details:

The Franklin Vale Initiative is a bold ambition to restore waterway health and catchment productivity.

Council is partnering with landholders living on Franklin Vale Creek to restore and improve the catchment condition by reducing instability and improving water quality through actions such as revegetation, cattle exclusion fencing, tunnel erosion mitigation and bank stabilisation.

This initiative offers landholders the opportunity to restore the waterways on their property and ultimately improve the overall health of Franklin Vale Creek.

Three stages of work how now been completed with over 32ha of land being revegetated.

Council is making a substantial investment in building a legacy of best practice land management where the productivity of the land is maintained for landholders, the community and the environment.

Franklin Vale Creek before and after stabilisation work

Woogaroo Creek Bank Stabilisation (Sites 7 & 9)

Location: Adjacent to Martin Coogan Park, Goodna

Catchment: Woogaroo Creek catchment

Treatment Type: Creek Stabilisation

Project Partners: Ipswich Rivers Improvement Trust and Port of Brisbane

Cost: Total Cost $280, 469 (cost shared 50/50 with the Port of Brisbane)

Total Pollutants Avoided*:

- TSS – 325,400 kg/yr
- TN – 137 kg/yr
- TP – 111 kg/yr

** Note: Only 50% of this pollutant reduction is being claimed by Council towards its offsite water quality improvement obligation since Port of Brisbane paid for half of the project cost (funded through Port of Brisbane's offset program).*

Site Context:

Two sites in lower Woogaroo Creek were identified in 2020 as showing signs of significant mass failure. One of these sites was on the right bank, upstream of Martin Coogan Park accessed through private property, and the second site was on the left bank immediately adjacent to Martin Coogan Park.

Following flood events in 2022, assessments suggested the sites were highly active, showing substantial bank retreat and generating significant volumes of sediment.

Project Details:

Council partnered with the Ipswich Rivers Improvement Trust in designing the stabilisation solutions, with the goal of implementing a holistic, nature-based solution to the on-going erosion. It was decided that the solution would incorporate natural materials wherever possible, as well as improve aquatic and riparian habitats.

The designs that were settled on involved re-profiling the streambanks to a stable grade, and then densely planting them out with native riparian vegetation. Pile fields were proposed to be used to protect the banks and vegetation over the intermediate establishment period, and large woody debris was designed to provide additional bank toe protection and aquatic habitats.

In early 2023, Council partnered with the Port of Brisbane in the on-ground delivery of these works which are now complete at both sites. Over the next 24 months, an intensive vegetation management program will be undertaken at these sites to limit the impacts of weeds and ensure the revegetation becomes established, which will provide the long-term stabilisation of the sites.

Woogaroo Creek (site 9) prior to stabilisation works

Woogaroo Creek (site 9) after stabilisation works

APPENDIX C: SUPPLEMENTARY TABLES

Table C 1: Water quality improvements achieved within each catchment

Catchment	Water Quality Improvement (kg/yr)			
	TSS	TP	TN	GP
Black Snake Creek	-	-	-	-
Bremer River	87,133	150	164	1,070
Brisbane River	-	-	-	-
Bundamba Creek	54,860	85	160	10,331
Deebing Creek	131,932	228	538	47,615
Goodna Creek	8,470	23	139	3,890
Ironpot Creek	423,170	30	126	767
Mihi Creek	6,570	9	36	1,120
Sandy Creek (Camira)	33,100	48	81	9,148
Six Mile Creek	-	-	-	-
Woogaroo Creek	172,703	67	96	898
Total	917,938	640	1,340	74,839

City of Ipswich

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