City of Ipswich

Voluntary Stormwater Quality Offset Program

Annual Report 2021-2022

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EXECUTIVE SUMMARY

In 2012 Ipswich City Council (ICC) embarked on a pioneering scheme to deliver coordinated water quality improvements in lieu of developers delivering on-site treatment.

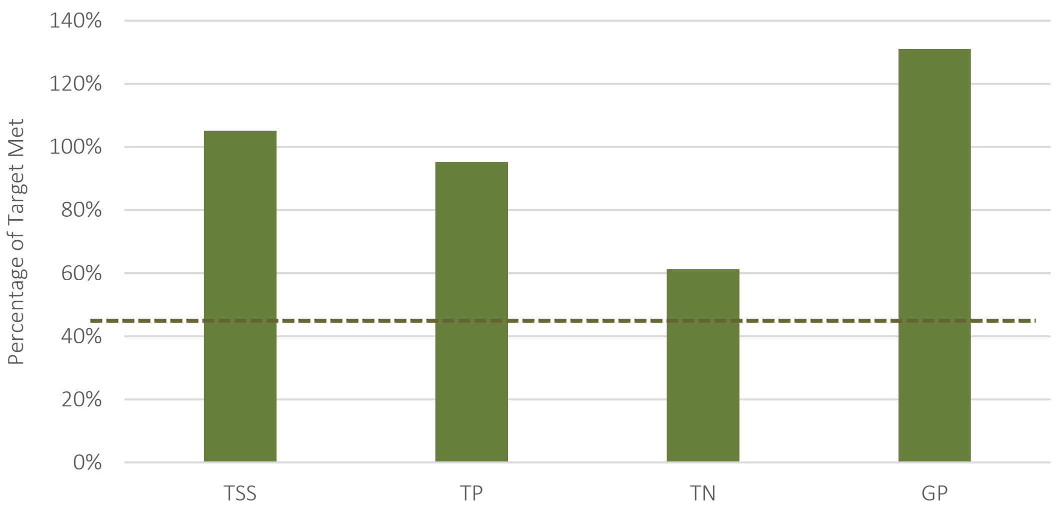
This voluntary scheme has become commonly known as the Stormwater Quality Offset Program.

ICC introduced the program to address underlying challenges with managing developer contributed stormwater treatment facilities (typically bioretention basins), as well as a proliferation of small-scale stormwater treatment devices.

The offset program conforms to various guidelines and implementation plans that direct aspects of the program such as eligibility, cost to developers, required water quality improvements and how ICC undertakes projects to meet the required water quality improvements.

In general ICC is making excellent progress in meeting its water quality offset liabilities, especially in relation to the amount of funds used. Utilising only 44 per cent of the total offset funds received, council has been able to achieve between 61 per cent and 131 per cent of its water quality improvement obligations (see Figure below).

The greatest water quality improvement has been achieved for Total Suspended Solids (105 per cent) loads and Gross Pollutants (131 per cent). 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.



Progress toward meeting ICC water quality offset obligations

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.

These projects are not only selected for their capacity to treat stormwater and improve water quality, but also the additional environmental and social benefits they provide, such as urban greening, increased biodiversity, carbon capture and flood mitigation.

Pursuing a spread of project types has also been an intentional tactic to not only spread risk but to try and learn and investigate where the best gains and most efficient investments can be made.

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.

It should also be acknowledged that the Small Creek Channel Naturalisation project, funded by the offset program, has won numerous awards in recognition of its achievements and sets the standard for other channel naturalisation projects across the region.

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

These include a 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.

1. INTRODUCTION

The State Government has mandated, through the State Planning Policy (SPP), that development above certain thresholds achieve load-based pollutant reduction objectives for stormwater quality.

The SPP also provides the opportunity for local governments to adopt locally appropriate alternative solutions, such as voluntary offsets schemes, whereby council takes on the responsibility to reduce pollutant loads that would otherwise be achieved onsite by developers in exchange for an equivalent cash contribution.

To facilitate a pathway for such innovative solutions, the Ipswich Planning Scheme Implementation Guideline No. 24 (IG24) (Ipswich City Council, 2016) establishes 'Voluntary Stormwater Quality Offset Payments' as an alternative to site-based treatment.

While there are many reasons for establishing a stormwater quality offset program, the two primary drivers for ICC included:

a) Minimising the proliferation of small-scale stormwater treatment facilities on infill development sites. These privately owned treatment facilities are very difficult and costly for ICC to ensure that they remain functional (e.g. effectively maintained).

b) Addressing an issue of poorly designed and constructed stormwater treatment assets which, once inherited from developers, councils were ill-equipped to manage.

In order to address these management issues, ICC developed a program that enabled a coordinated approach to the management of stormwater quality via a voluntary contribution scheme, more commonly referred to the Stormwater Quality Offset Program (though it should be noted that this voluntary mechanisms differs in significant ways from other legislated 'offsets' such as those in place under state and local planning scheme for Koala habitat or Matters of Environmental Significance).

Implemented strategically, an offsets program, such as the Stormwater Quality Offset Program, can deliver a net benefit to the environment.

In the case of water quality offsets, the ecological assets in question are the City's waterways that are highly susceptible to changes in hydrology, hydraulic conditions, and sediment and nutrient loads.

The potential net benefit in water quality (compared to developer-led projects) is the result of two factors.

Firstly, the offset program can maximise water quality improvements through a greater variety of projects, types and locations.

Secondly, the offset program can leverage additional funds to increase the scope or size of a project that would otherwise not have been feasible.

In addition to water quality improvements, strategically implemented offset projects can achieve a broad variety of additional benefits that may not otherwise have been achieved through developer led stormwater quality management.

Pollard Park Channel Naturalisation (November 2022)

These additional benefits can include but are not limited to public amenity and aesthetics, urban greening, increased biodiversity, carbon capture, flood mitigation and broader waterway health benefits beyond water quality.

Inherent in any type of environmental offset program however are trade-offs: the sacrifice of one ecological asset to deliver a benefit elsewhere.

A robust offsets program must take account of key guiding principles established under a number of offsets policies and guidelines.

Specifically, offsets must ensure environmental equivalence, taking account of spatial separation and temporal lags, and be designed to minimise them.

While the ICC Stormwater Quality Offset Program has been successful in delivering a net environmental benefit since it started, there is an ongoing need to review the program and adapt to ensure a continued improvement.

Internal and external review of the program has identified a few key areas that need to be addressed, including a looming shortfall in cost effective projects for ICC to meet its offset obligations, maintenance challenges and improvements to the eligibility criteria.

A recommended requirement of the offset delivery program is to produce an annual report in order to ensure and maintain an open and transparent process.

This report summarises the financial contributions made to ICC, the water quality liabilities the council inherits with the financial contribution and the progress made in fulfilling the inherited liability.

Finally, this report provides insight into the proposed future direction of the program.

2. HOW THE STORMWATER QUALITY OFFSET PROGRAM WORKS

Broadly speaking, a water quality offset program involves improving water quality in one location to offset deterioration of water quality at another location due to development activity.

For the ICC Stormwater Quality Offset Program 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 (LGA).

The council has prepared Implementation Guidelines under the Planning Scheme (Ipswich City Council, 2016 – under review) to ensure a standard approach to how and when a voluntary offset payment can be made by a developer.

Similarly, Implementation Plans have been prepared for council to follow to ensure that the best possible outcomes are achieved when delivering offset projects (BMT WBM, 2015; E2DesignLab, 2020).

Based on requirements of the State Planning Policy (SPP), the water quality parameters of concern in the offset program are Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorus (TP) and Gross Pollutants (GP).

Figure 1 summarises how the offset program works.

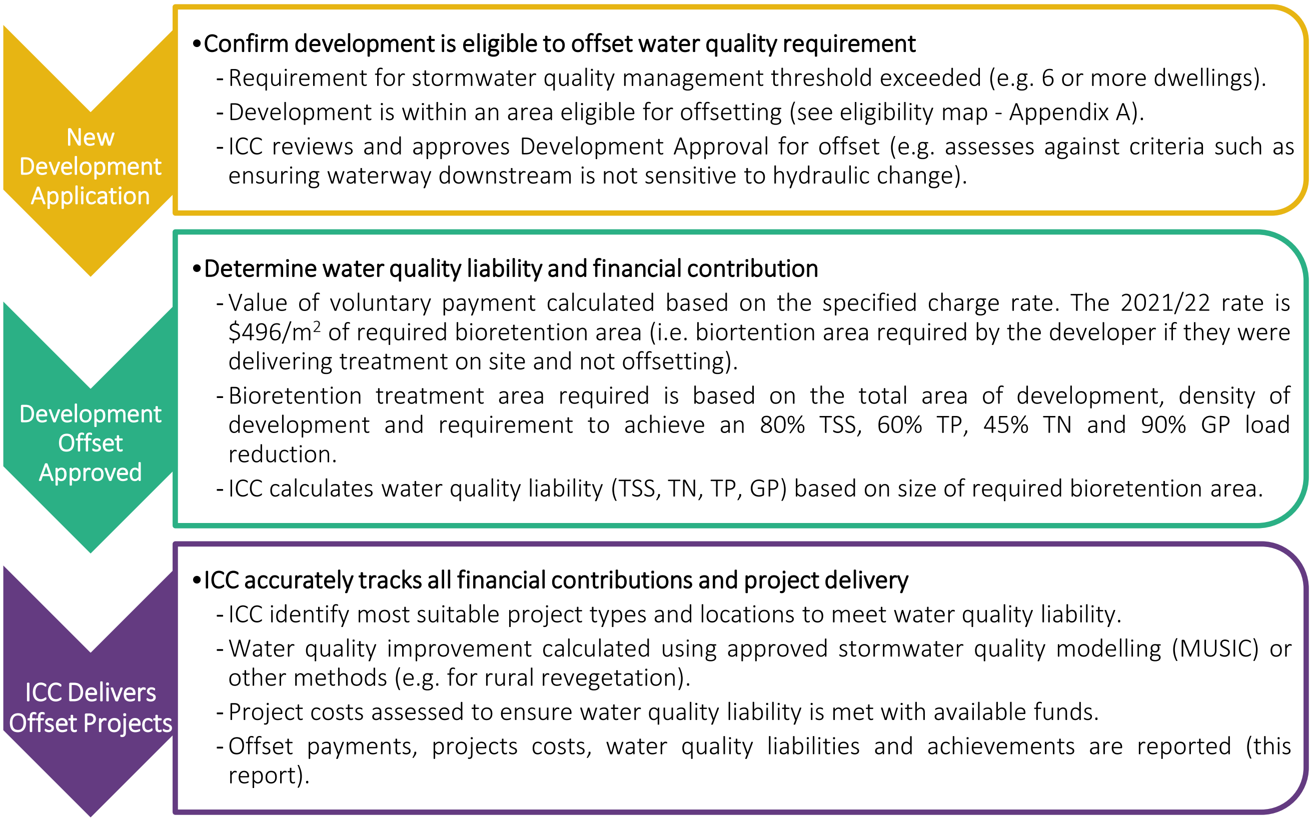


Figure 1: Overview of how the Stormwater Quality Offsets Program works

3. STORMWATER QUALITY OFFSETS PROGRAM STATUS

3.1 Summary

Council has expensed 44 per cent of the offset revenue received (Table 1) and delivered between 61 per cent and 131 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 105 per cent of its TSS and 61 per cent of TN reduction obligations, utilising only 44 per cent of the funds received.

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

The following section provides more detail into financial contributions received, the water quality liabilities associated with the financial contribution and the projects that have been undertaken to address the liability.

Table 1: Stormwater Quality Offset Program overall financial status at the end of 2021/2022 financial year

	Funds (,000)
Total Revenue	$22,693
Total Funds Expensed*	$9,962
Balance Remaining	$12,731
Percentage of Funds Spent	**44%**

Table 2: Progress toward meeting water quality offset obligation

	Pollutant Type (kg/yr)			
	TSS	**TP**	**TN**	**GP**
Total Liabilities	389,409	568	1,927	57,142
Total Credit Achieved*	409,489	541	1,180	74,839
Outstanding Liabilities	-20,080	28	747	-17,697
Percentage of Target Met	**105%**	**95%**	**61%**	**131%**

*Credits are for constructed projects only

3.2 Financial contributions and water quality liabilities

The voluntary stormwater quality offsets scheme has been very popular with developers, leading to council collecting in excess of $22.6M since December 2014/15.

For each dollar contributed, the council incurs a water quality liability for each parameter specified in the SPP which must be offset 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 2021/22 council has acquired a liability to prevent over 389,000kg/yr of TSS and 1,900kg/yr of TN from entering Ipswich's waterways with the revenue received (Table 3).

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
Total	**$22,693,201**	**389,409**	**568**	**1,927**	**57,142**

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

To assist in long-term program planning, a projection of offset 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 offsets within the eligible area.

The forecast was first completed in 2015, and updated in 2020 (see BMT WBM, 2015 & E2Design Lab, 2020).

Overall, the demand for the Stormwater Quality Offsets Program has been consistent with the forecasted demand, as seen in Figure 2.

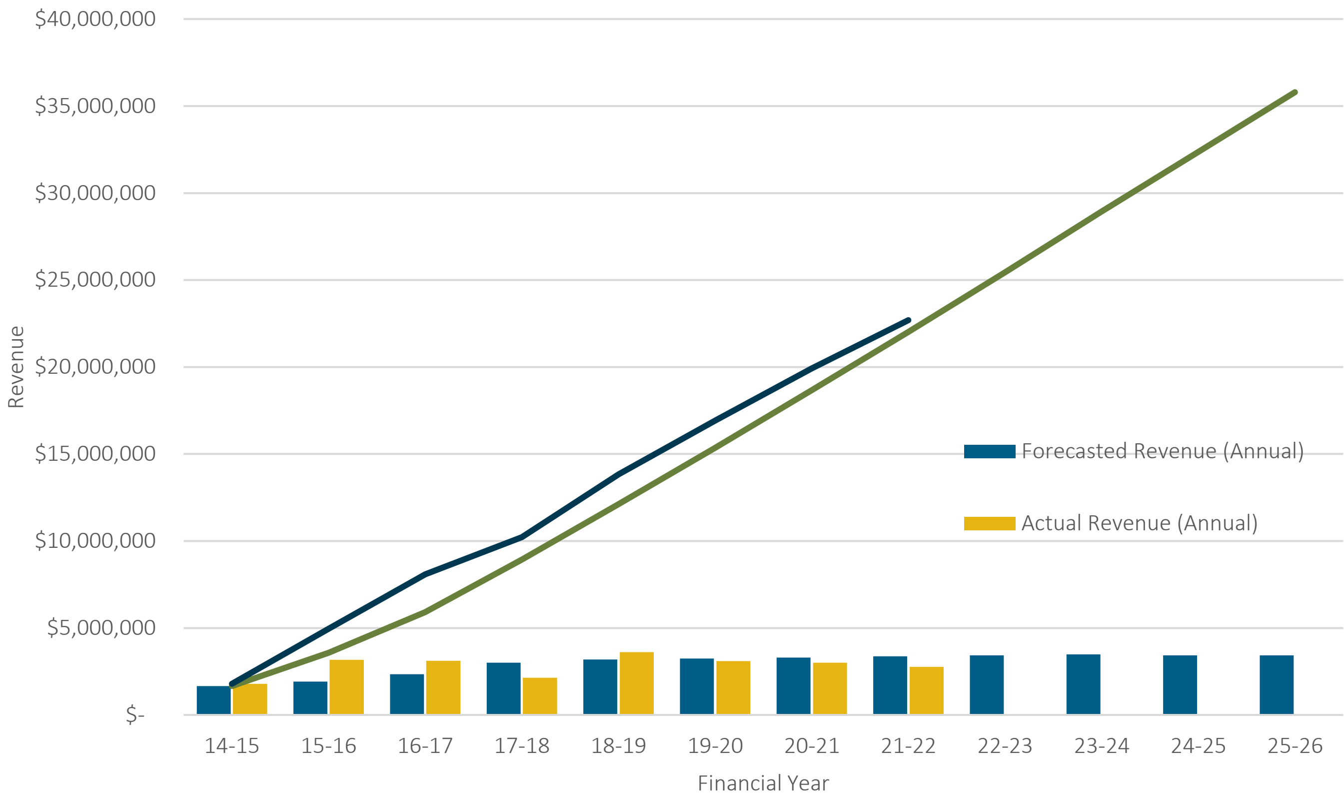


Figure 2: Forecasted versus actual revenue

Two key observations from the forecasted versus actual revenue data presented in Figure 2 include:

a) In the first 5 financial years of the program (excluding 2017/18), actual revenue was greater than the forecasted revenue by between approximately $0.1M and $1.2M.
b) In 2025/26 the total cumulative revenue is forecasted to be approximately $35M. However, if the past difference between forecast and actual revenues continues the actual revenue could be over $37M.

3.3 Water quality improvements and project expenses

3.3.1 Stormwater Quality Offset Projects

In order to meet council's water quality liability, sixteen stormwater quality offset projects have been constructed over twelve different locations (two locations have multiple stages) as shown in Figure 3.

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 sixteen 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.

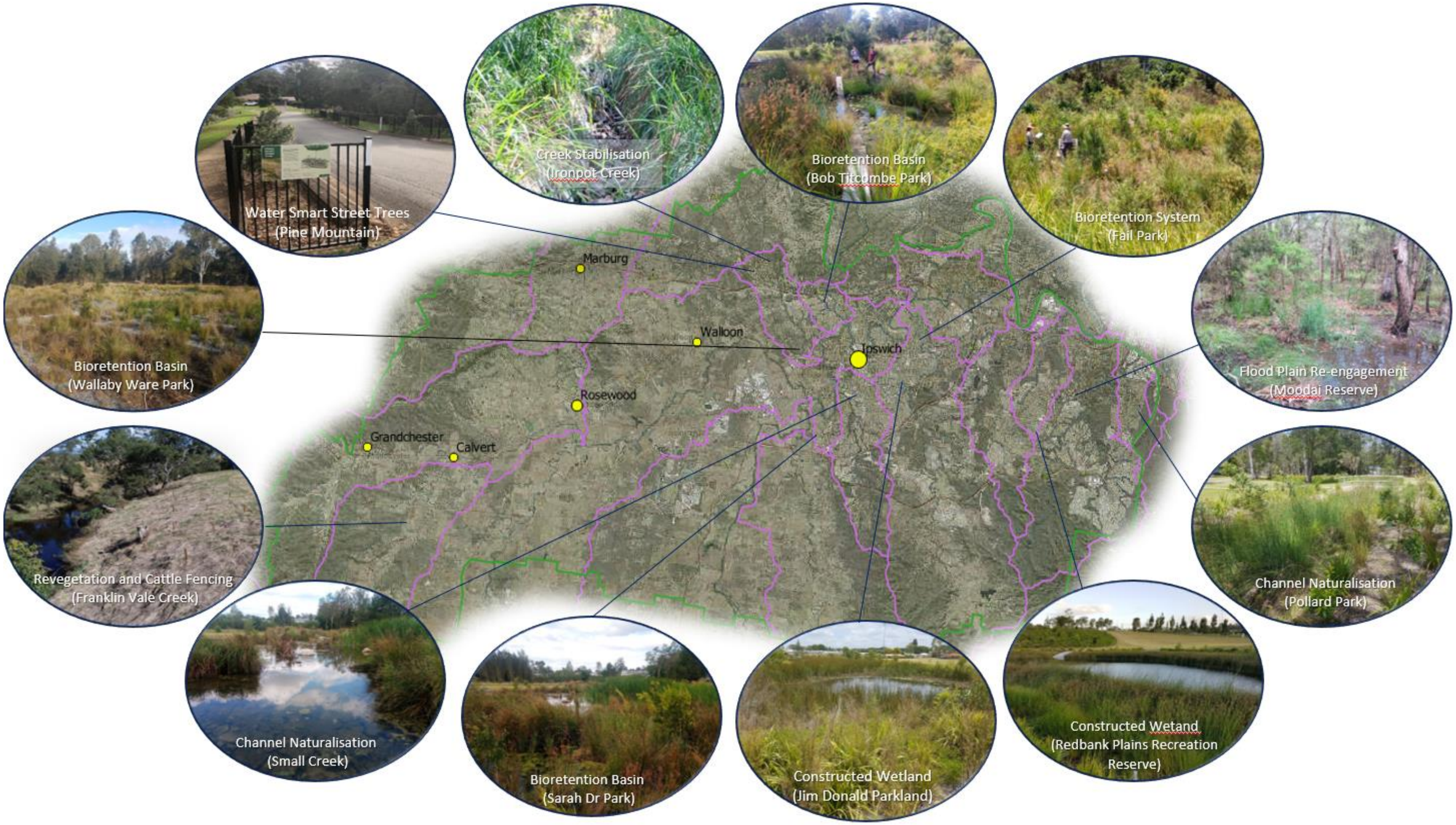


Figure 3: Constructed stormwater quality offset projects location and treatment method/project type

Table 4: Key benefits of various project types and stormwater quality offsets projects

Project Type	Location of Completed Projects	Key Project Benefits
Creek Stabilisation &/or Channel Naturalisation	• Ironpot Creek • Pollard Park • Small 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	• 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

3.3.2 Water quality improvements delivered

3.3.2.1 Project pollutant reductions

The sixteen water quality improvement projects delivered through the Stormwater Quality Offset 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 409,489kg/yr and 1,180kg/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.

Table 5: Water quality improvements achieved for completed project

Project	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	63,477	110	97	-
Ironpot Creek Stabilisation	Ironpot Creek	88,770	7	36	-
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
	Total	**409,489**	**541**	**1,180**	**74,839**

Using the assumptions proposed in the Implementation Plan (BMT WBM, 2015), rural revegetation and cattle exclusion is a highly cost-effective method of achieving the water quality objectives and can 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 offset sites 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 offset credits achieved at the project's maturity (assumed to be at 20yrs) 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.

3.3.2.2 Catchment pollutant reductions

In order to adequately reflect on the success of the program and understand environmental equivalence, spatial separation must be considered.

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

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

ICC 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.

To date, the sixteen water quality improvement projects have been constructed in eight catchments within the Ipswich LGA.

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

Figures 4 and 5 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.

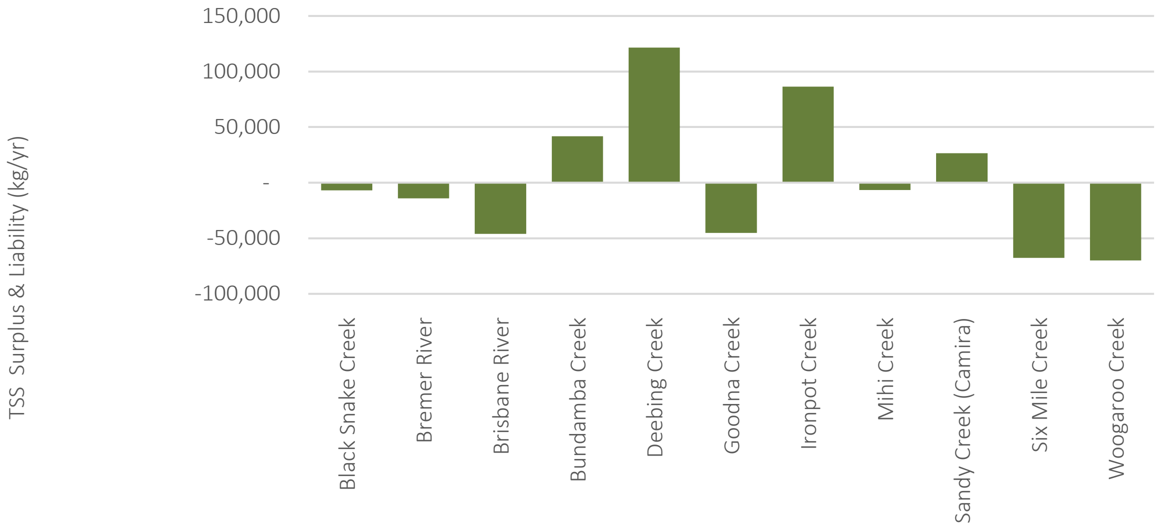


Figure 4: TSS catchment surplus and liability

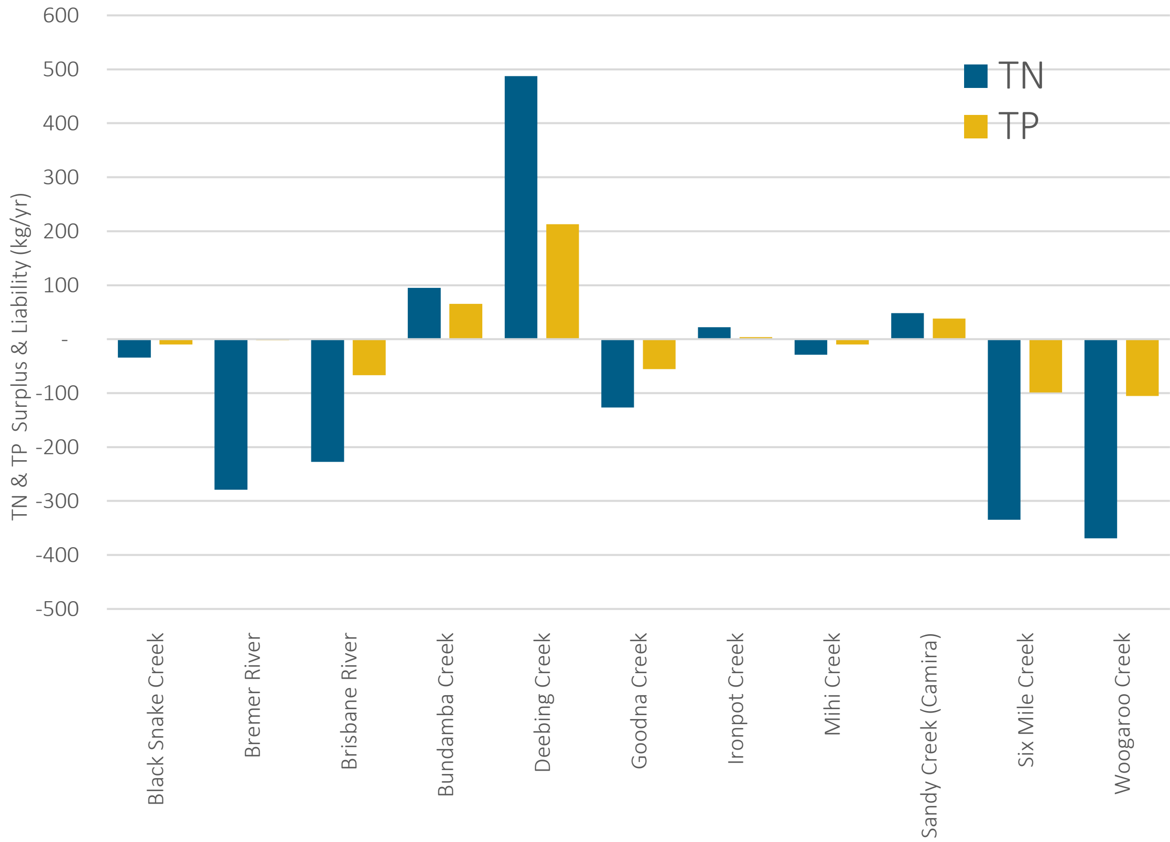


Figure 5: TN and TP catchment surplus and liability

The figures show that, to date, both Deebing Creek and Ironpot Creek have a significant surplus in TSS as a result of the large-scale channel naturalisation (Small Creek Channel Naturalisation) and creek stabilisation (Ironpot Creek Stabilisation) projects that have been undertaken in these catchments.

Conversely, many catchments also display a net deficit for all water quality parameters (TSS, TP and TN). For example, currently no projects have been completed in Six Mile Creek, despite ICC having received offset payments within this catchment. This analysis highlights spatially, where offset impacts are greatest and where delivery sites should be located so that this spatial separation can be most effectively accounted for.

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.

3.3.3 Project expenditure

The total cumulative expenditure for constructed projects as of June 2022 was in order of $12.7M, of which the Stormwater Quality Offsets Program contributed approximately $9.9M while non-offset funding (e.g. grants, ICC sub-programs) contributed the remaining $2.8M. This equates to more than 77 per cent of the total project cost being funded by voluntary stormwater quality offset contributions.

The cost of individual projects varies substantially depending on the scale and complexity of the project, with some projects costing as little as $135,000 (Water Smart Street Trees) and others costing significantly more at over $7M (Small Creek Naturalisation) (Figure 6). 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.

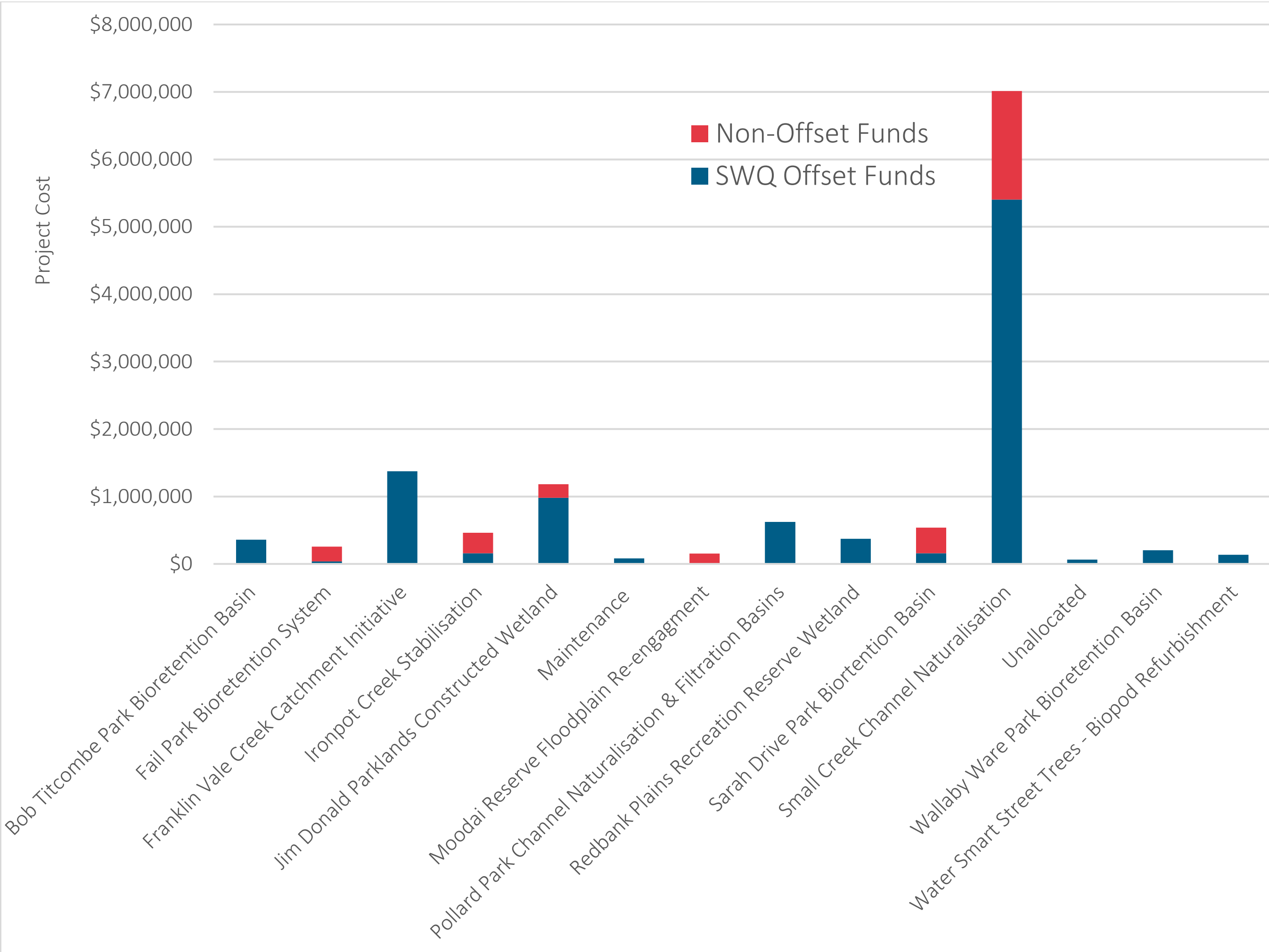


Figure 6: Total expenses for each of the constructed stormwater quality offsets projects (Note: Unallocated funds refers to cost associated with completing the 2020 Implementation Plan update

The proportion of offset revenue to non-offset revenue applied to each project ranged between 4 per cent and 100 per cent. For example, the Stormwater Quality Offset Scheme funded 4 per cent, 77 per cent and 100 per cent of the Moodai Reserve, Small Creek and Pollard Park projects, respectively. Since the additional funds applied were from non-offsetting sources, all the pollutant reductions (TSS, TP, TN and GP) achieved by the projects were credited towards ICC's offset liability.

Figure 7 shows a breakdown of cost based on stormwater treatment method or project type. It indicates that more than 60 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 (SEQ).

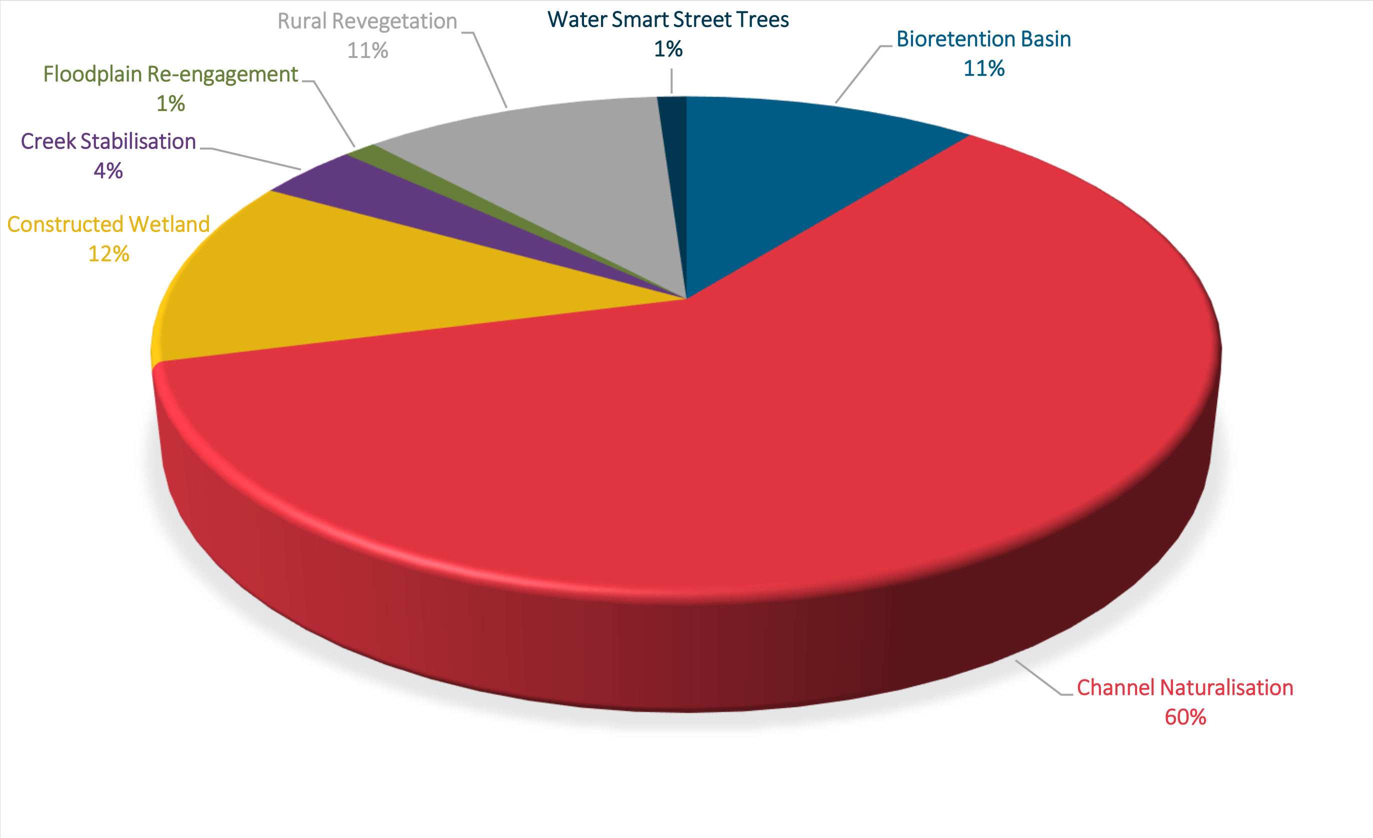


Figure 7: Expenditures according to primary project type

3.4 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 the Stormwater Quality Offsets Program, the importance of a project providing multiple additional social, environment and economic co-benefits should not be undervalued. As such, these co-benefits should continue to play an important role in project selection.

The cost-benefit assessment of constructed water quality improvement projects, presented in Figure 8, show a wide range of cost efficiencies that vary between project types and the water quality parameters.

- For TSS, the cost-benefit ranged from $5 to $82 per kg of TSS removed, with the Ironpot 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 $18,900 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.

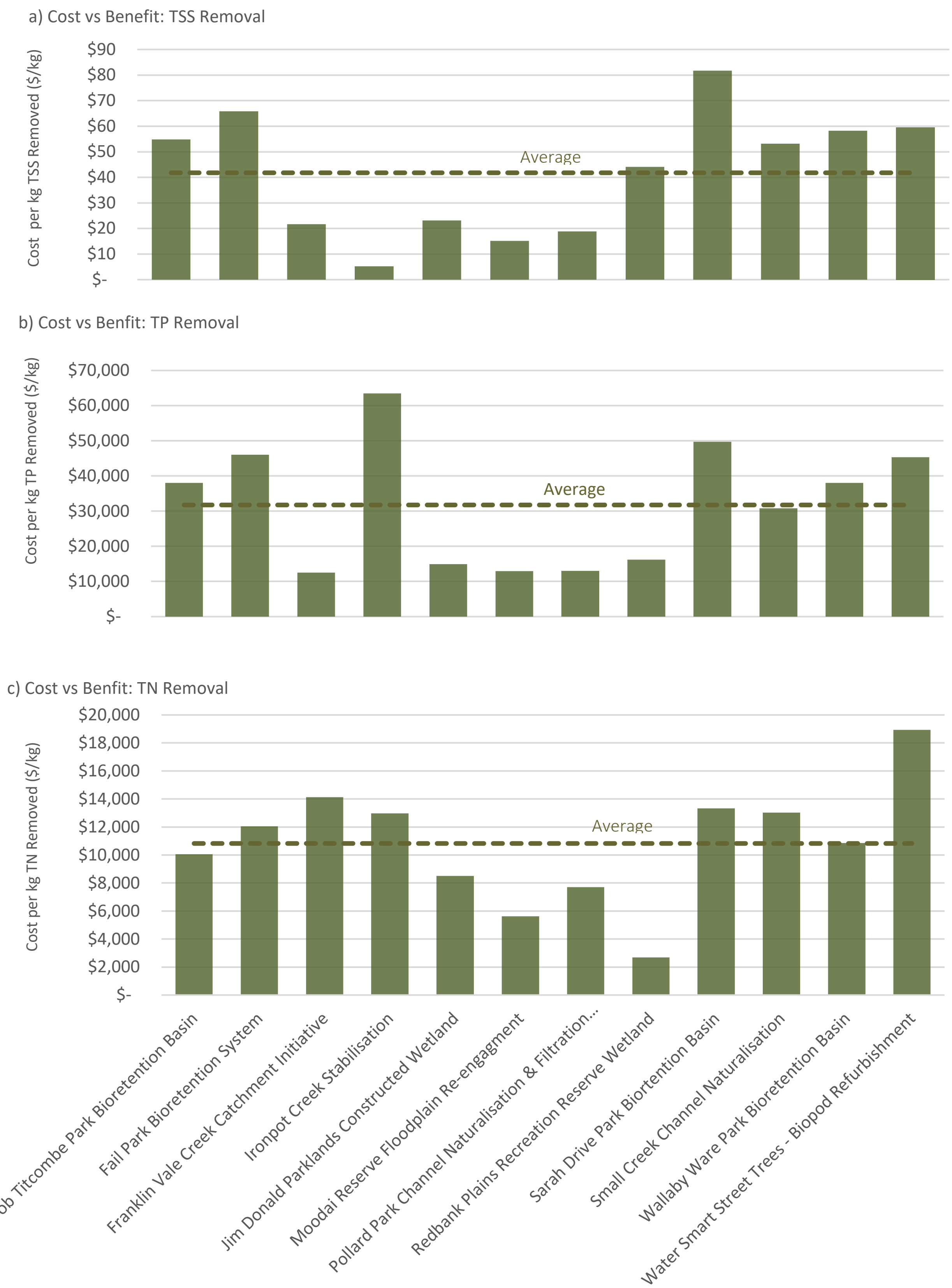


Figure 8: Cost-benefit analysis of completed projects

Note: This analysis only considers the water quality benefits achieved and does not consider multiple additional social, environmental and economic co-benefits.

4. FUTURE DIRECTION

4.1 A continuing role for a stormwater quality offset program

While the Stormwater Quality Offset Program faces some challenges, the many benefits it provides are a good justification for solving these challenges and securing the program for the long-term.

The benefits provided include a net improvement in water quality and the many aforementioned co-benefits such as flood mitigation, increased biodiversity, habitat creation and community amenity, all of which would not be achieved to the same extent if the alternative of developer contributed bioretention facilities occurred.

It should also be noted that much of the offset liability is created from smaller, infill development which, without the alternative of offsetting, would result in a significant number of small privately owned treatment facilities across the city.

It would be very difficult to ensure these small, dispersed facilities, located on private lands, were being adequately maintained to ensure continued functionality and pollutant reduction.

A regulatory framework for maintaining the voluntary offset program is clearly identified within the State Planning Policy (SPP, 2017) and Supplementary Implementation Guidance (2021), stating "At the post-construction phase, development... (b) achieves an alternative locally appropriate solution off-site that achieves an equivalent or improved water quality outcome to the relevant stormwater management design objectives" (SPP, 2017) and "If a developer opts for an off-site solution and the relevant Local Government agrees, then the Local Government collects an 'in-lieu fee' which must be used to develop stormwater solutions off-site" (SPP guidance, 2021).

Based on the opportunity presented within the SPP, Council is looking to retain the voluntary program in the long-term while also ensuring: (i) changes are made to improve conformity to State guideline; (ii) full cost-recovery is attained; and (iii) efficient delivery and effective outcomes continue to be achieved.

4.2 Adapting to a declining supply of cost-effective project opportunities

As already noted, council is achieving a high level of project efficiency, accomplishing between 61 per cent and 131 per cent of its water quality improvement obligations while utilising only 44 per cent of the total offset funds received.

However, the number of sites remaining where cost effective projects can be undertaken are becoming scarcer. Council recognises that the long-term viability of the program is at risk due to the scarcity of cost-effective offset sites, necessitating changes to how the program is delivered and how developer contributions are calculated. In response to these challenges, council has/is taking the following actions:

1. Completed a second Implementation Plan that undertook a detailed assessment of potential offset project opportunities (see E2Designlab, 2020). While this plan identified over forty opportunities, the practicality and feasibility of project delivery in many sites is in question triggering the need for a more detailed feasibility analysis.

2. Completed a detailed feasibility assessment of the offset project opportunities proposed by the E2Designlab (2020) study. Analysis of the forty plus potential projects identified that many of the proposed sites were not feasible when specific site constraints, such as the land contamination, slope, susceptibility to flooding and presence of existing infrastructure, were considered. That being said, approximately fourteen opportunities have been identified, including constructed wetlands, ephemeral wetlands, daylighting pipes, channel naturalisation and bioretention facilities. Based on this assessment, projects for at least the next 5 to 7 years have been identified.

3. Transitioning offset opportunities from the current approach of centralised/end-of-line facilities (e.g. bioretention facilities and constructed wetlands) to decentralised/at-source opportunities that can be readily integrated into the existing urban areas. For example, the water smart street tree project has

Water Smart Street Tree: An example of how multiple small-scale projects can treat stormwater within urban areas.

demonstrated how multiple small-scale facilities (i.e. water smart street trees) in an existing residential area can provide cost effective water quality improvement without the need for large open spaces. Continued success of the program will be reliant on adapting to a broader suite of cost-effective Water Sensitive Urban Design (WSUD) techniques, such as bioswales and infiltration trenches, while also ensuring the program supports broader ICC strategic outcomes and does not leave a legacy of high maintenance costs.

4. Reviewing, and if necessary, increasing the developer contribution payment value. In addition to considering the future increase in water quality improvement project costs, the review needs to evaluate other additional costs currently incurred but not included in the current payments value. These may include program administration costs, inflation, land purchase, delivery and equivalence ratios and project maintenance costs.

4.3 Maintenance – ensuring water quality improvements are lasting

The water quality improvements gained from the stormwater quality offset projects (see Table 5) assume the water quality assets will be adequately maintained in order to perform, as designed and built, into perpetuity. It is therefore imperative, that all delivered water quality assets are routinely inspected and maintained.

While ICC has an active inspection, maintenance and rehabilitation program, the capacity of the program to ensure adequate upkeep of the facilities is limited.

This is especially evident when considering the total number of existing ICC stormwater quality assets, as well as the continuous dedication of new assets to council from development and the Stormwater Quality Offsets Program.

ICC continues to improve the maintenance process and build towards a more mature assets systems management approach to plan and budget for both offset projects and developer contributed assets.

Without a change in the current commitment to the inspection and maintenance of the stormwater quality assets, the water quality benefits gained from these projects will be lost and the capital investment in these facilities wasted.

Testing infiltration rates at Fail Park Bioretention System

4.4 Increasing certainty of project performance

Broader discussion within the SEQ stormwater community, also supported council observation, has identified the need for improved understanding of the performance of water quality improvement projects, like those delivered in this offset program.

These observations underline 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.

Increased certainty of water quality modelling will: (a) help ensure equivalency in offset liability and credits; and (b) help ensure cost-effective solutions are implemented.

The case for undertaking performance monitoring is reinforced by the pursual of diverse decentralised stormwater management solutions.

4.5 Changes to Stormwater Quality Offset Policy in the new Planning Scheme

Council is preparing a new planning scheme, Ipswich Plan 2024, that will replace the current Ipswich Planning Scheme 2006. This new Planning Scheme provides an opportunity to review and update Stormwater Quality Offset Policies.

While still in development, ICC is seeking to ensure the program improves its consistency with the State Guidance (SPP guidance, 2021). For example, ICC is assessing whether eligibility to offset water quality can only occur in instances where Council can clearly demonstrate, through an offset delivery plan, the specific projects it would complete to meet the water quality improvement obligation it would inherit.

The offset delivery plan would have to demonstrate how the project would achieve spatial and temporal equivalency with the developments water quality improvement requirements.

5. CONCLUSION

The Stormwater Quality Offsets 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 sixteen constructed projects, either completely or partially funded by stormwater quality offsets, have collectively contributed toward achieving ICC's pollutant reduction obligations, achieving at worst a 61 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 recognized 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 Stormwater Quality Offsets 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.

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

6. REFERENCES

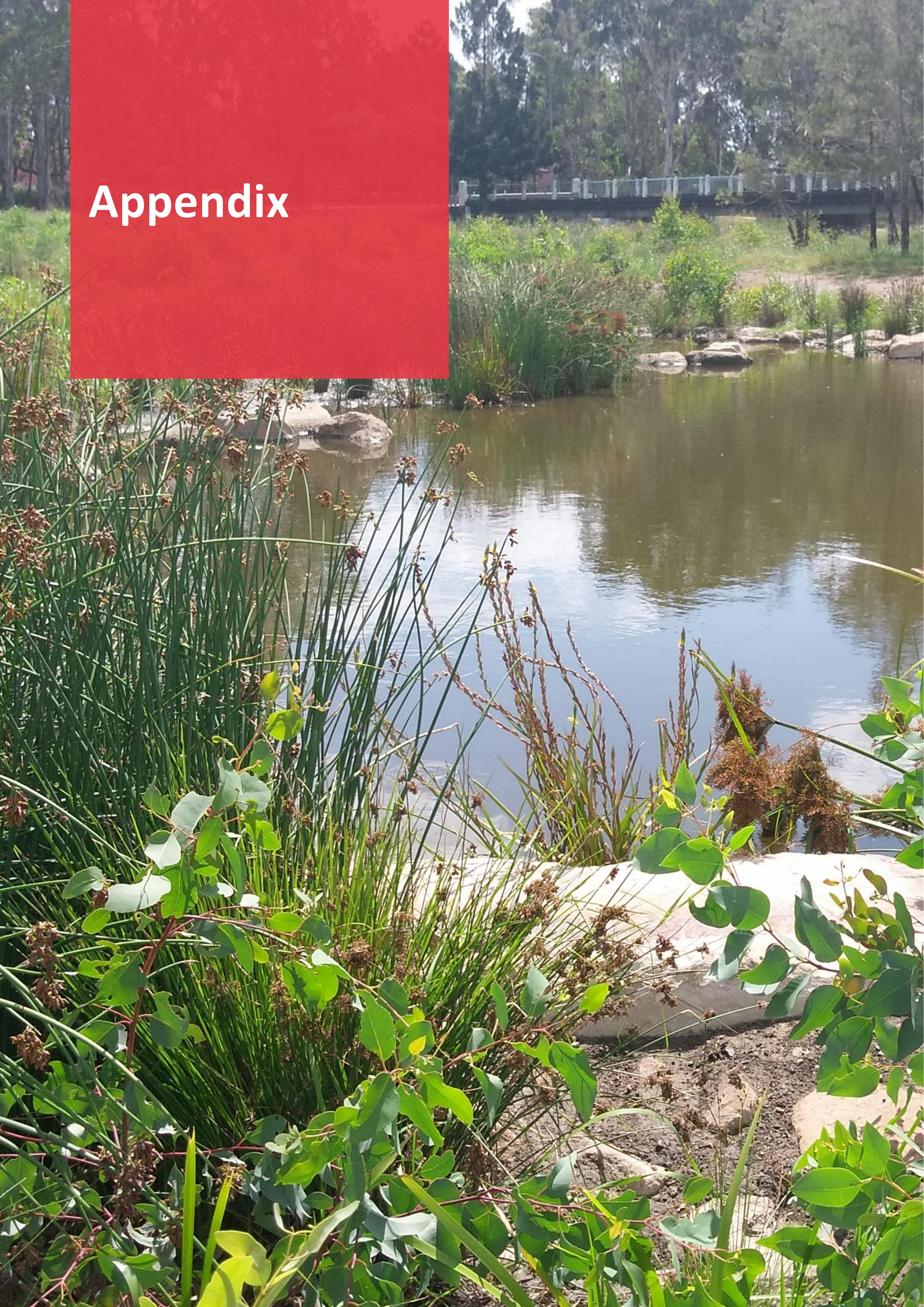
BMT WBM (2015), Ipswich City Council Stormwater Quality Offsets Implementation Plan

E2Designlab (2020), Ipswich City Council Stormwater Quality Offsets Implementation Plan

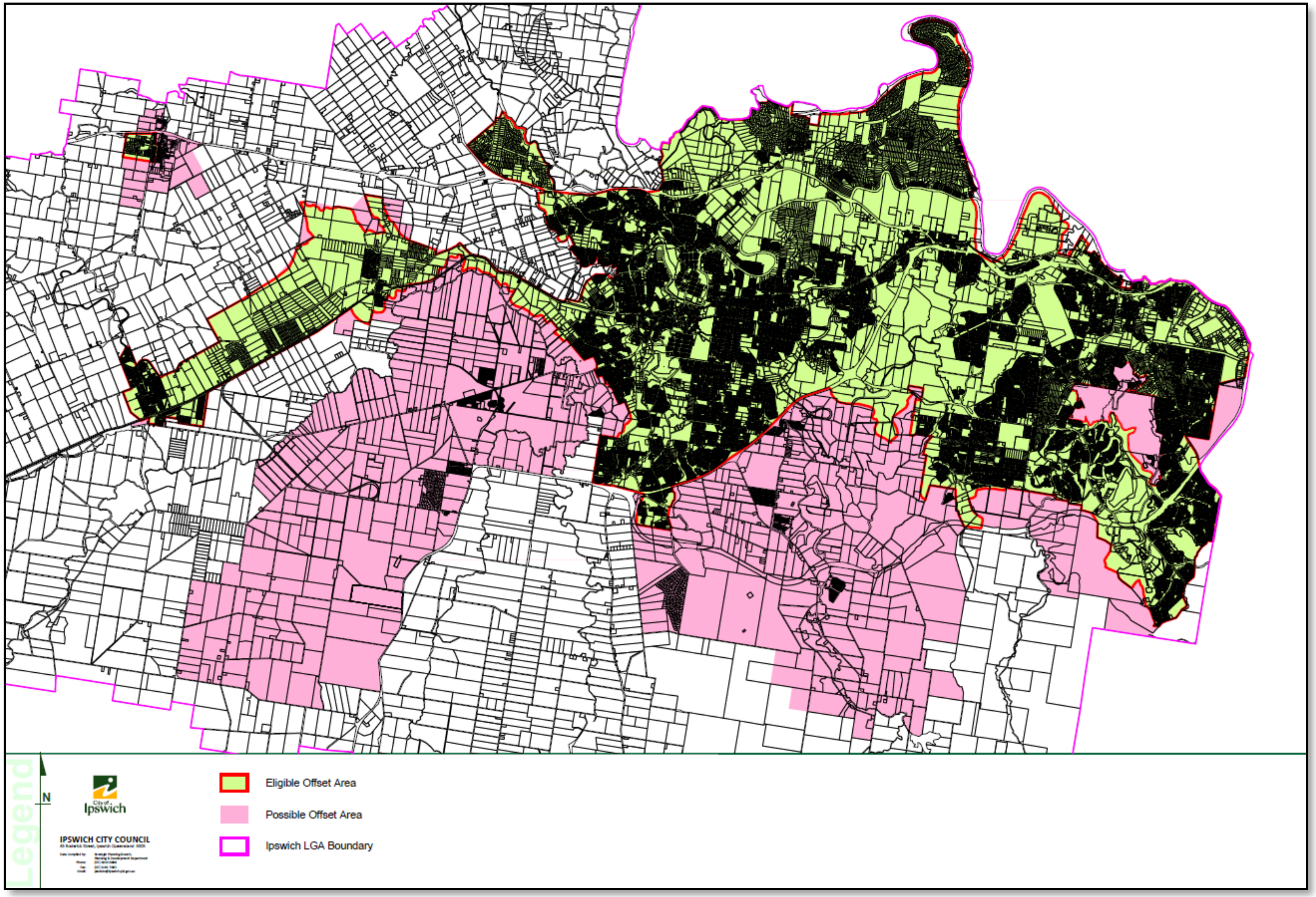
Ipswich City Council (2016), Implementation Guide No. 24: Stormwater Management

SPP Guidance (2021), State Planning Policy State Interest Water Quality 2017 Supplementary Implementation Guidance, Department of Environment and Science, February 2021

Appendix



APPENDIX A: OFFSET ELIGIBILITY MAP



APPENDIX B: PROJECT SUMMARIES

Please see the following pages for summaries of existing ICC Stormwater Quality Offsets projects

- Ironpot Creek Stabilisation – Stages 0 & 1
- 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

Ironpot Creek Stabilisation – Stages 0 & 1

Location: Walter Zimmerman Park, Pine Mountain

Catchment: Ironpot Creek

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

Project Partners: Alluvium Consulting (Stage 0), Australian Wetland Consulting Pty Ltd (Stage 1)

Pollutants reductions:

- TSS - 88,770kg/yr
- TN - 36kg/yr
- TP - 8kg/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 project developed a strategy to reduce 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.

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.

Large vertical unstable banks have been proposed to be battered back to a stable 1:3 grade.

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 0 and 1, 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

Project Partners: Engeny Water Management

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

Project Partners: Alluvium Consulting

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

Project Partners: Bligh Tanner, Landscapology, Streamology, The Landscape Construction Company, Alluvium

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 offsets 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

Project Partners: Engeny Water Management

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

Project Partners: BMT WBM

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

Project Partners: E2Design Lab, AWL

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

Project Partners: E2DesignLab and AWL

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

Location: Sarah Drive Park, Yamanto

Catchment: Bremer River

Treatment Type: Bioretention Basin

Project Partners: E2DesignLab and AWL

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 during final stages of construction

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

Project Partners: E2DesignLab, AWL

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)

Project Partners: Australia Wetlands Landscapes

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

Project Partners: Landholders, Australian River Institute

Pollutants reductions (In reporting year):

- TSS – 63,477 kg/yr
- TN – 97 kg/yr
- TP – 110 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.

ICC 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 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.

Two 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

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	70,047	121	138	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	94,506	16	61	767
Mihi Creek	6,570	9	36	1,120
Sandy Creek (Camira)	33,100	48	81	9,148
Six Mile Creek	-	-	-	-
Woogaroo Creek	10,003	12	27	898
Total	**409,489**	**541**	**1,180**	**74,839**

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