GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

PARKS AND WILDLIFE SERVICE

Canning Plain Catchment Local Water Quality Improvement Plan Review Summary

August 2017

Acknowledgements
Thank you to the Cities of Canning and Belmont, and the South East Regional Centre for Urban Landcare (SERCUL) for their contributions to the review of the Canning Plain Catchment Water Quality Improvement Plan.

Purpose and use of this document
The Department of Biodiversity, Conservation and Attractions (DBCA), with the support of the organisations noted above, has reviewed the implementation of the Canning Plain Catchment WQIP. The purpose of this document is to summarise that review and inform future updates of the Canning Plain Catchment WQIP. The Swan Canning Water Quality Improvement Plan is proposed to be reviewed in 2018 and if undertaken any updated catchment modelling will be used to inform updates of the local WQIPs. It is intended that these documents will be used by partner organisations that will continue to have a role in implementation of the WQIPs.

Front cover photos: Swans and cygnets. Photo – P. Walker/City of Canning
Wharf Street Constructed Wetland outlet structure, Cannington. Photo – DBCA

Local Water Quality Improvement Plans

The Department of Biodiversity, Conservation and Attractions (DBCA) Parks and Wildlife Service works to reduce nutrients and other contaminants entering the Swan and Canning rivers.

DBCA (and previously the Swan River Trust) developed and invested in the implementation of local Water Quality Improvement Plans (WQIPs). The WQIPs were designed to provide stakeholders with a mechanism to prioritise recommendations and resources and seek funding to improve water quality in catchments contributing the greatest amount of nutrients and contaminants.

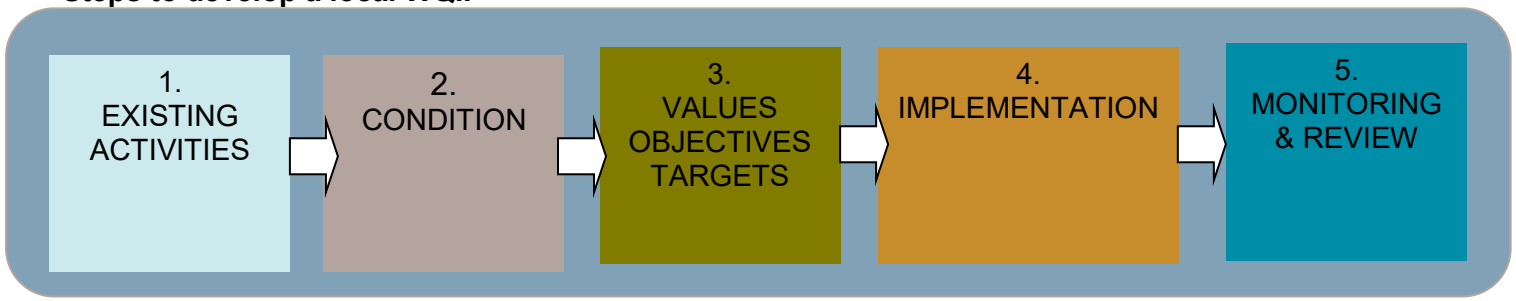
WQIP implementation takes a treatment train approach with actions falling into each of the following stages in the pathway of nutrients and non-nutrients from the source to the discharge point:

1. **Prevention** (Land use planning)
2. **Minimisation** (Ecoefficiency)
3. **Reduction** (Source control)
4. **Amelioration** (Conveyance and transmission)
5. **Treatment – Reuse – Disposal**

Water Quality Improvement Plans:

- identify water quality issues and hot spots;
- identify environmental values of water bodies and water quality objectives required to protect the values; and
- identify and commit to a set of cost-effective management measures to achieve and maintain those values and objectives.

Steps to develop a local WQIP

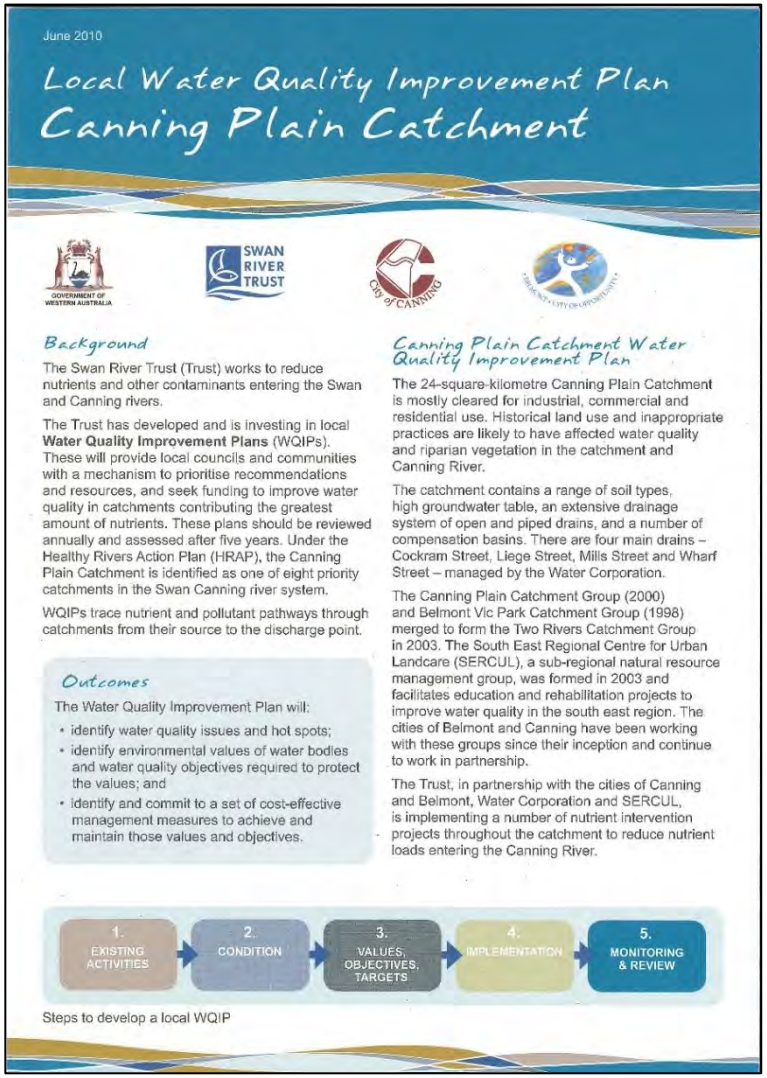


Local WQIP Review

Ten local WQIPs were developed between 2008 and 2012 with strong involvement of key stakeholders. Implementation of the WQIPs is ongoing, however many of the actions are complete or require review. There are also actions that are still underway and others that will require an ongoing commitment and additional resources to maintain and improve water quality. This review of the Canning Plain Catchment WQIP, is based on achievements and stakeholder participation.

There has been significant investment in on-ground nutrient interventions in the Canning Plain Catchment through the Drainage and Nutrient Intervention Program (DNIP). The monitoring associated with the Canning Plain DNIP projects provides evidence that specific projects are improving water quality in this catchment. Monitoring the effects of non-structural WQIP actions, such as community education and behaviour change programs, and changes to policies and procedures, on catchment water quality is more complicated. Therefore, statistically linking WQIP actions to changes in catchment water quality is not attempted at this stage. Variations in annual flow, changes in catchment land uses, and the long timeframes required for some catchment management practices to affect water quality at the catchment discharge point are other factors that can contribute to discharge water quality.

The Swan Canning River Protection Strategy supports the development and implementation of the Swan Canning and local WQIPs as an action to achieve nutrient load reduction targets and provides the framework for DBCA to update local WQIPs. This review will determine the local WQIPs to be updated based on the level of support from key stakeholders and need for further water quality improvement. Modelling of water quality improvement targets is proposed to occur as part of an update of the Swan Canning WQIP in 2018.


June 2010

Local Water Quality Improvement Plan
Canning Plain Catchment

GOVERNMENT OF WESTERN AUSTRALIA
SWAN RIVER TRUST
CITY of CANNING

Background

The Swan River Trust (Trust) works to reduce nutrients and other contaminants entering the Swan and Canning rivers.

The Trust has developed and is investing in local **Water Quality Improvement Plans** (WQIPs). These will provide local councils and communities with a mechanism to prioritise recommendations and resources, and seek funding to improve water quality in catchments contributing the greatest amount of nutrients. These plans should be reviewed annually and assessed after five years. Under the Healthy Rivers Action Plan (HRAP), the Canning Plain Catchment is identified as one of eight priority catchments in the Swan Canning river system.

WQIPs trace nutrient and pollutant pathways through catchments from their source to the discharge point.

Outcomes

The Water Quality Improvement Plan will:

- identify water quality issues and hot spots;
- identify environmental values of water bodies and water quality objectives required to protect the values; and
- identify and commit to a set of cost-effective management measures to achieve and maintain those values and objectives.

Canning Plain Catchment Water Quality Improvement Plan

The 24-square-kilometre Canning Plain Catchment is mostly cleared for industrial, commercial and residential use. Historical land use and inappropriate practices are likely to have affected water quality and riparian vegetation in the catchment and Canning River.

The catchment contains a range of soil types, high groundwater table, an extensive drainage system of open and piped drains, and a number of compensation basins. There are four main drains – Cockram Street, Liege Street, Mills Street and Wharf Street – managed by the Water Corporation.

The Canning Plain Catchment Group (2000) and Belmont Vic Park Catchment Group (1998) merged to form the Two Rivers Catchment Group in 2003. The South East Regional Centre for Urban Landcare (SERCUL), a sub-regional natural resource management group, was formed in 2003 and facilitates education and rehabilitation projects to improve water quality in the south east region. The cities of Belmont and Canning have been working with these groups since their inception and continue to work in partnership.

The Trust, in partnership with the cities of Canning and Belmont, Water Corporation and SERCUL, is implementing a number of nutrient intervention projects throughout the catchment to reduce nutrient loads entering the Canning River.

1. EXISTING ACTIVITIES → 2. CONDITION → 3. VALUES, OBJECTIVES, TARGETS → 4. IMPLEMENTATION → 5. MONITORING & REVIEW

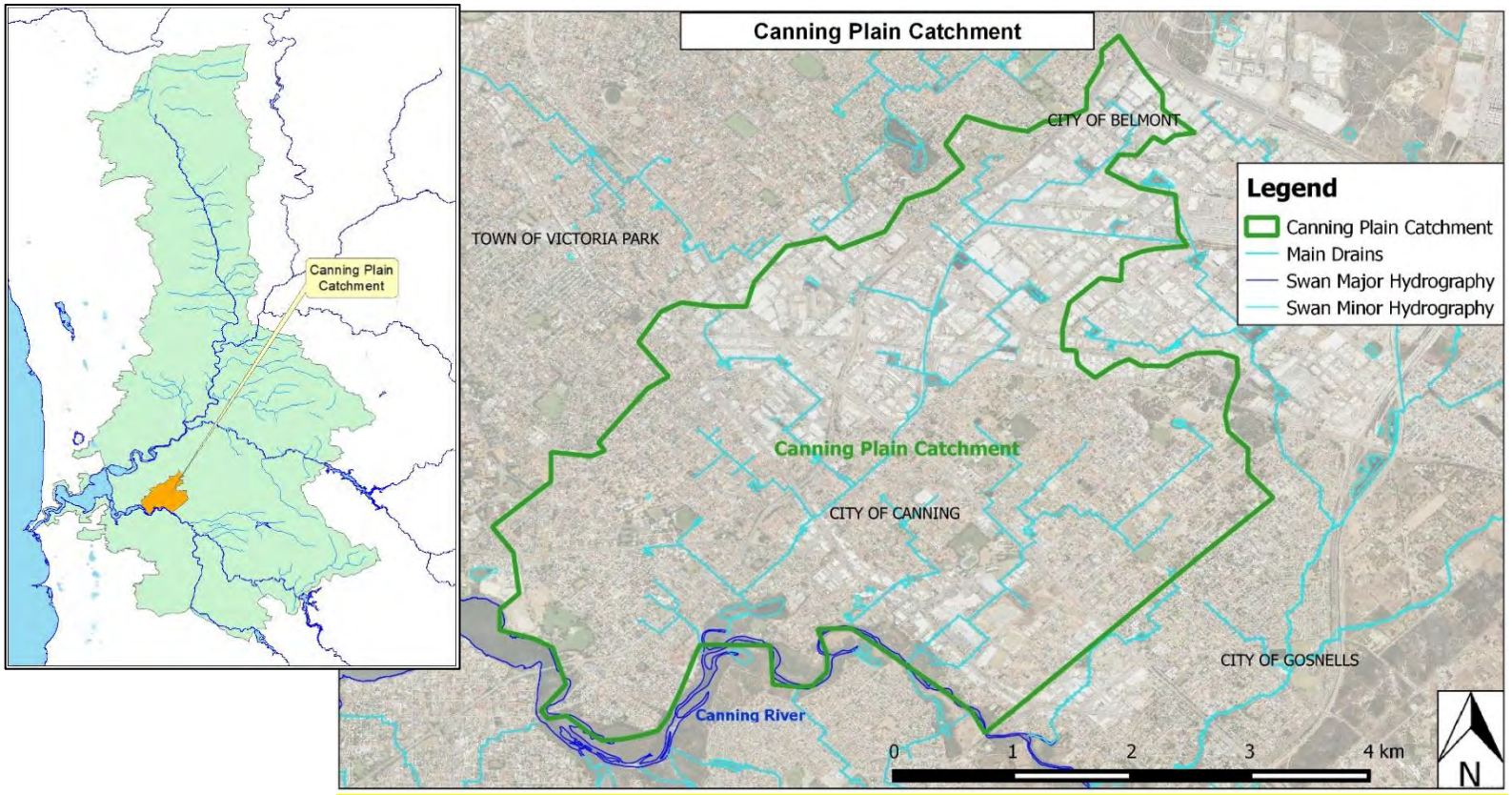
Steps to develop a local WQIP

Local WQIP front cover for illustration purposes only

Canning Plain Catchment

The 24-square kilometre Canning Plain Catchment is mostly cleared for industrial, commercial and residential use. The catchment contains a range of soil types, high groundwater table, an extensive drainage system of open and piped drains, and compensating basins.

There are four main drains within the Canning Plain Catchment, Mills Street, Cockram Street, Liege Street and Wharf Street, all with a history of poor water quality. Most of the catchment falls within the City of Canning, with a smaller area containing the most upstream portion of the Mills Street main drain falling within the City of Belmont. The Water Corporation manages the main drains for flood protection of the surrounding industrial, commercial and residential areas. Local government managed drains feed into the Water Corporations main drains. Several of the compensating basins connected to the main drains are within parks and recreation reserves also managed by local governments.



Canning Plain WQIP Review Summary

The Canning Plain WQIP has a total of 25 actions, 84 percent of those have been addressed: including two that have been completed or are on track to completion; and 19 that are implemented but will require ongoing commitment or further investment for catchment-wide implementation. There are four actions that have had little or no progress (see Appendix 1 for details).

Positive action is being taken in this catchment towards Perth's transition to becoming a Water Sensitive City, for example Water Sensitive Urban Design (WSUD) is imbedded into the City of Canning's City Centre redevelopment plans, and the Department of Communities (Housing) and City of Canning's major redevelopment plans for Bentley. However, there is a lot more work to be done to achieve catchment-wide WSUD implementation.

Major projects:

- Wharf Street Constructed Wetland and Civic Parkland, Cannington – monitoring and evaluation.
- Anvil Way Living Stream, Welshpool – construction, establishment and monitoring.
- The City of Canning and the City of Belmont are partners in the 2015-17 Light Industry Program, with the Department of Water and Environmental Regulation and Department of Biodiversity, Conservation and Attractions.

The Cities of Canning and Belmont are working in partnership with the Department of Water and Environmental Regulation (DWER) and Department of Biodiversity, Conservation and Attractions (DBCA) to implement the 2015-17 Light Industry Program. Businesses in Welshpool and Kewdale have been audited and provided information and advice to improve environmental performance, particularly where businesses could be negatively affecting stormwater or groundwater. The compliance rate among those initially audited has increased significantly since the audits began, reducing the risk of pollutants entering the waterways from the industrial premises in the catchment.

Significant investment into on-ground water quality improvement projects has occurred in this catchment. Intensive monitoring and evaluation of the constructed Wharf Street Wetland has been undertaken showing that 45 percent of phosphorus and 65 percent of nitrogen is removed through the innovative series of open water bodies, surface and subsurface treatment wetlands making up the system. The wetland also removes metals, sediment and other contaminants from the stormwater that pass through it. The Wharf Street Wetland provides treatment to 94 percent of the water flowing to the Canning River via the Wharf Street main drain (CRCWSC, 2015). The project was awarded Stormwater WA's Award for Excellence in Research and Innovation in 2015, and recognises the project partnership between DBCA, the City of Canning and the South East Regional Centre for Urban Landcare (SERCUL).

The end-of-catchment treatment provided by the Wharf Street Wetland, adds significantly to the smaller trial projects in the Manley Street and Tarun Court compensating basins constructed further upstream in the Wharf Street main drain catchment prior to the WQIP development. Bioretention trenches were installed in both basins to remove nitrogen and phosphorus from a portion of the flow entering the basins.

The Anvil Way Living Stream, another major DNIP project in the Canning Plain Catchment, was constructed in a compensating basin in Welshpool industrial area within the Mills Street main drain catchment in 2010. The project saw the removal, treatment and reuse of 1400 cubic metres of contaminated sediment from the basin and installation of approximately 130,000 local native plants to reduce nutrients and contaminants in the Mills Street main drain, and increase the basin's habitat value.

The Mills Street main drain median total phosphorus concentration passed both the short and long-term targets (0.2mg/L and 0.1mg/L respectively) for the first time in 2014. Mills Street main drain has passed the short-term median total nitrogen concentration target since 2002 however, is still failing the long-term target of 1mg/L (Departments of Water and Parks and Wildlife, Swan Canning Catchment Nutrient Report Update 2015).

Community capacity and understanding of environmental values has increased in the Canning Plain Catchment over the life of the WQIP. SERCUL provides support to environmental community groups and opportunities for volunteering in catchment restoration. SERCUL also delivers community education and behaviour change programs, such as the Phosphorus Awareness Program and Fertilise Wise Training funded by the Australian and State governments through the DBCA. The City of Canning supports and manages the Canning River Eco-Education Centre which is an invaluable resource for schools and community groups as a place to gather for classes, workshops and experiences on the banks of the Canning River.

There has been substantial investment from Federal, State and Local governments and the community in delivering the Canning Plain WQIP actions and the DNIP projects. An initial Canning Plain WQIP investment of $125,000 adds to the DNIP investment of approximately $1,825,000 from DBCA. In-kind support (resources, administration costs, project management, technical support, staff time, and volunteering) provided by project partners has been an additional significant contribution to the on-ground projects in this catchment.

The Canning Plain WQIP initially helped overcome the council boundaries and encouraged working on water quality improvement with a whole-of-catchment approach. Feedback from the local governments and SERCUL indicates that ongoing meetings and a system of reporting that continued past the initial investment period would have helped maintain commitment to the actions. Consultation and input from all relevant areas of the local governments (Environment, Engineering, Planning, Maintenance and ground staff) and ensuring that the actions are imbedded into the local governments strategic plans, policies and processes, and endorsed by the councils is essential to gaining ongoing commitment to an updated WQIP.

Local WQIP Action Review Summary

WQIP catchment	Release date	Total number of actions	Actions fully achieved or on track	Actions implemented but ongoing commitment required	Actions with little or no progress	% of actions being implemented
Canning Plain	June 2010	25	2	19	4	**84**

Summary of investment in WQIP					
	Department of Biodiversity, Conservation and Attractions initial WQIP investment and DNIP investment	Other State Government investment	Federal Government	Local Government and Community	**Total Investment**
Investment in Canning Plain WQIP projects	$2,007,661	$1,183,930	$25,000	$226,817	**$3,443,409**

Future priorities and actions – Canning Plain Catchment

- Implement the Swan Canning River Protection Strategy.
- Ensure all new development and infill/retrofit proposals are in line with Perth's transition to a water sensitive city.
- Ensure that all local government planning schemes and policies support the transition to a water sensitive city.
- Land-use planning decisions to ensure the State Planning Policy 2.10 (Swan Canning River System) requirement for developers to maintain or improve water quality is upheld.
- Ensure all new developments are connected to sewer and aim for infill sewer to all existing urban areas.
- Increase community awareness, education and involvement in catchment management to reduce nutrient and contaminant outputs.
- Continue to take opportunities to retrofit existing drainage systems in line with Water Sensitive Urban Design (WSUD) principles.
- Continue to look for, and take opportunities to improve water quality, habitat, and community benefit of wetlands and vegetated areas in the catchment.
- Reduce council's nutrient outputs through local management practices by providing up-to-date training to all staff involved in fertiliser application, grounds keeping and maintenance of drainage infrastructure.
- Discourage the planting of deciduous trees near drainage infrastructure to reduce organic loads and excessive nutrients entering stormwater in Autumn when the rivers are susceptible to algal blooms.
- Review frequency of maintenance activities in drainage infrastructure (such as drain eduction activities).
- Seek commitment to maintain Light Industry Audits for an ongoing program to prevent industrial pollutants entering surface and groundwater.

Canning Plain Catchment Case Study: Anvil Way Living Stream

The Anvil Way Living Stream was constructed within an existing compensating basin in Welshpool industrial area to improve water quality in the Mills Street main drain before it continues to the Canning River. The project was completed through the Drainage and Nutrient Intervention Program in a partnership arrangement between the Department of Biodiversity, Conservation and Attractions, the City of Canning and SERCUL, with funding support from the State NRM and consultation with the Public Transport Authority (land owner), Department of Water and Environmental Regulation and Water Corporation.

The living stream's meandering flow path increases the detention time of the stormwater and groundwater that passes through it before it reaches the Canning River. During construction, 1400 m^3 of accumulated sulfidic sediments contaminated with metals and hydrocarbons were removed from the basin and treated, and the new living stream includes a sedimentation pond to collect and allow easy removal of sediment accumulating into the future, removing the associated contaminants with it. The living stream has a low-flow diversion from a minor inlet to the main inlet of the living stream to enhance water quality improvement and an adjustable outlet weir allowing manipulation of the water levels.

The project involved the installation of 130,000 plants, all local native species. In 2017 the vegetation is well established, and along with the associated biofilms, takes up nutrients from the stream water and groundwater that enters the basin. The vegetation also improves habitat potential of the basin for water birds and other native fauna in an industrial area otherwise lacking these types of refuges. The project has been closely monitored since construction, this monitoring has identified that low dissolved oxygen in influent waters is affecting the ability of the living stream to remove and retain nutrients. Management actions to address this issue are being undertaken.

Before construction 2010

During construction 2011

Established 2017

Anvil Way Living Stream

June 2009

July 2015

Area of project site:	0.9 ha
Volume of contaminated sediment treated:	1,400 m^3
Number of seedlings planted:	130,000
Cost of project construction:	$935,000
Project partners:	Department of Biodiversity Conservation and Attractions, State NRM, City of Canning, SERCUL, Department of Water and Environmental Regulation, Public Transport Authority, Water Corporation.

Appendix 1: Canning Plain Catchment WQIP – Action Review

Tally and explanation of action review categories – Canning Plain Catchment			
Total number of actions	**25**	**Percentage**	**Explanation**
Action achieved	1	4	The action has been completely fulfilled.
Action on track	1	4	Significant progress has been made and the action is likely to be completed in the near future.
Ongoing action	14	56	This action will require ongoing commitment or maintenance.
Projects/Programs implemented	5	20	There are projects and programs in place that address this action, however significantly more investment is required to enable catchment wide implementation.
Little or no progress	2	8	Little or no progress has been made on this action. This can be for various reasons.
No longer relevant or viable	2	8	Can be for various reasons.
Summary categories			
Total number of actions	**25**	**Percentage**	**Explanation**
Action fully achieved or on track to being achieved	2	8	First two categories above combined.
Action implemented but ongoing commitment required	19	76	Second two categories above combined.
Little or no progress	4	16	Last two categories above combined.

Canning Plain Catchment WQIP - Action Review

Treatment train approach	Management strategies	Implementation actions	Lead organisations	Supporting partners	Status comment	Review category
1. Prevention Land use and planning	**1.1** Review urban and infrastructure planning to incorporate best management practices	**1.1.1** Integrate the use of predictive modelling and decision support tools to determine priority sites to reduce nutrient exports	Department of Planning, Lands and Heritage (DPLH), City of Canning (CoC), City of Belmont (CoB)	Department of Water and Environmental Regulation (DWER), South East Regional Centre for Urban Landcare (SERCUL), Department Biodiversity, Conservation and Attractions (DBCA) (previously Swan River Trust)	• Modelling was used to determine priority sub-catchments for nutrient reductions and key strategies in the development of the Swan Canning Water Quality Improvement Plan (WQIP). A review of the modelling is proposed to commence in 2017-18. • The CoC drainage design team are trained in the use of DWER's 'UNDO' tool.	
		1.1.2 Ensure water sensitive urban design is part of all coordinated redevelopment structure plans consistent with the requirements of the Better Urban Water Management, State Planning Policy 2.9 Water Resource and local environmental conditions			• CoC town centre redevelopment project underway incorporates WSUD. • CoC and Department of Communities (Housing) intend to incorporate local water sensitive management strategies into Bentley Redevelopment. • CoC is a participant in the CRC for Water Sensitive Cities and has been benchmarked using the WSC Index. This will help the City focus investment on areas most needing improvement in the transition to becoming a water sensitive city.	
		1.1.3 Undertake strategic asset planning to identify opportunities to reduce groundwater interception and increase bio filtration treatment in open drain sections of the system			• Prioritisation of Canning Plain drains and compensating basins was undertaken by the Drainage and Nutrient Intervention Program (DNIP) in 2004 (before the WQIP development) and many of the priority sites for nutrient reduction have had works completed through the program over the years since. • The Drainage for Liveability Partnership between Water Corporation (WC) and DWER provides an opportunity to review WC assets and capital works program to identify new drainage improvement opportunities that may not have been an option previously. SERCUL conducted a survey of prospective sites in the	

					Welshpool industrial area, and is involved in a current opportunity to upgrade of Mills Street Basin with WC.	
	1.2 Application of water sensitive urban design (WSUD) practices	**1.2.1** Develop and implement standard development conditions for Small to Medium Enterprises in industrial areas to incorporate appropriate wastewater treatment and disposal	CoC, CoB	Department of Water and Environmental Regulation (DWER), DBCA, SERCUL	• CoB Environment section contributes to the City's annual review of standard development conditions including conditions relating to stormwater drainage systems. • CoB Light Industry Officer advises the City's Development Control Group on environmental implications of commercial and industrial development applications and other planning matters dealt with by the City's planning officers. A substantial proportion of this advice centres around trade wastewater-generating activities and the relationship of potentially polluting activities to onsite and offsite stormwater drainage systems. • CoC - Standard conditions are being applied to new commercial and industrial premises to install a bin/equipment wash down facility that is connected to sewer, to prevent unauthorised disposal to stormwater. Car wash bay conditions have also been standardised. • In 2011-12 CoC and CoB had a review of policy and mechanisms to better manage discharge from Light Industry to reduce the impact on the groundwater, drains and waterways. The project drew on existing projects and resources to provide policy review, approvals review (conditions and guidelines), local law review and capacity building and implementation.	
		1.2.2 Include Stormwater Manual Water Sensitive Urban Design (WSUD) principles in future road capital works programs	CoC, CoB, Main Roads WA	DWER, SERCUL	• CoC - Stormwater Management Plan (in development) will incorporate WSUD. • CoC has installed drainage cells to infiltrate stormwater at site. WSUD elements have been included at Dabchick Park and the Bunnings redevelopment at Westlake Street.	

		1.2.3 Develop a policy to protect existing local government open drains from becoming closed systems and where possible implement living stream principles	CoC	SERCUL, DWER	• CoC - Stormwater Management Plan is being developed with a focus on capacity issues in the catchment but will also incorporate WSUD. • CoC's existing *Policy ET521 Subdivision and Developments – Environment* (2009) requires that stormwater design shall be based on the principles of water sensitive urban design. • In 2017 Water Corporation released a guidance note for Living Stream Design. This could help local governments achieve this action in their own drains. The Drainage for Liveability Program also encourages local governments to submit project proposals to WC for improving WC drainage reserves where multiple benefits can be achieved (i.e. community or environment).	
		1.2.4 Ensure WSUD incorporates the other uses and functions of the particular location, including aesthetics, crime prevention through environmental design, and universal access principles to facilitate safe use for all people	CoC, CoB		• This is an ongoing principle of WSUD to provide multiple benefits to the community and that each site should be considered in its own context. • Aesthetics and recreational opportunities have been considered in DNIP projects throughout the Canning Plain Catchment.	

	1.3 Continue to monitor water quality throughout the Canning Plain Catchment	**1.3.1** Seek funding and identify responsibility to implement on-going water quality monitoring in the Canning Plain Catchment	DBCA, Perth NRM	SERCUL, CoC, CoB, DWER	• CoC - Current water quality data collection is financially supported by the City of Canning. SERCUL is engaged to undertake testing and report on findings. • CoB - the City of Belmont's Stormwater Monitoring program (SG-C-BELMONTSMP) has been operating for several years with a review taking place in 2016 and additional sites added. •The Urban Drainage partnership consolidated an understanding of all water quality monitoring that was occurring throughout the Swan Canning Catchment. DBCA is one of the numerous supporting partners in the research into efficiency of constructed sites in catchments through the Cooperative Research Centre (CRC) for Water Sensitive Cities (WSC) program. Monitoring of sites occurring, not entire catchments. Data was reviewed to prioritise areas for compliance audits through the Light Industry Program. • Research into efficiency of constructed wetlands has resulted in performance assessment reports and associated summary reports for Anvil Way Living Stream compensation basin and Wharf Street Constructed Wetland.	
		1.3.2 Identify sites currently contributing to nutrient and non-nutrient load based on a review of historical land use data	SERCUL, CoC, CoB, DEC	Universities (e.g. Curtin)	• CoC - Review of historical land use data has not been undertaken. Current water quality data collection is financially supported by the City of Canning. SERCUL engaged to undertake testing and report on findings. • CoB - the City of Belmont's Stormwater Monitoring program (SG-C-BELMONTSMP) has been reviewed. Sites within this catchment may be added to the program based on the review. • DBCA - partially completed as a part of DNIP site selection within the catchment and placement of DNIP projects. Yet to review historical land use data for further prioritisation.	

2. Minimisation Efficiency in nutrient use	**2.1** Expand urban education in efficient fertiliser management	**2.1.1** Reduce urban fertiliser use through education and accreditation programs	DBCA, CoC, CoB	SERCUL	• DBCA support the Phosphorus Awareness Program delivered by SERCUL and Fertiliser Wise Fertiliser Training. Fertiliser Wise training offered at Canning River Eco Education Centre (CREEC).	
	2.2 Reduce nutrient and non-nutrient input from industry	**2.2.1** Encourage local government to adopt or maintain audits of Small to Medium Enterprises to ensure compliance with the *Environmental Protection (Unauthorised Discharge) Regulations 2004*	Perth NRM	CoB, CoC, DER	• DBCA and DWER are partnering with the CoC and CoB to audit light industrial premises in the Canning Plain Catchment as part of the National Landcare Program funded 2015-17 Light Industry Program. Audits began in 2015. CoC and CoB committed officers to jointly audit businesses in their areas with the DWER Light Industry Officer. • CoB - Light Industry Officer conducted or attended 111 inspections of businesses in the Canning Plain Catchment over the 2015-16 financial year. Assessing and increasing compliance with the Unauthorised Discharge Regulations is central to the inspection program. • Street drains in the Kewdale industrial area were stencilled with Drains to River message. • CoC - As at 25 October 2016 there were 133 audits completed at 122 light industrial premises. Post inspection correspondence has been provided following each inspection, outlining practices requiring improvement and recommendations aimed at guiding business toward best industry practices in the management of waste and the environment. There has only been the need for punitive action on one occasion to date, with a modified penalty being issued to a vehicle wrecking yard, upon soil samples confirming hydrocarbon contamination. Achievements and impact of the program will be reported in the final quarter of 2017. • An earlier Light Industry Audit Program (funded by the then Swan River Trust and State NRM) implemented by Perth NRM in 2010/11 focussed on minimising the discharge of contaminants from light	

					industrial small and medium size enterprises located in the catchments of the Swan and Canning rivers. Businesses at risk of causing pollution were provided with recommendations and information on achieving compliance with relevant environmental legislation and improving their current business practices. Businesses were then re-visited and re-assessed during the project period. 138 businesses in Kewdale and 389 in Welshpool were audited. The total number of audits in this catchment was 843 including initial and follow-ups. • In November 2011 an Environmental Projects Officer was engaged through a joint agreement between the Swan River Trust, City of Belmont and City of Canning to support implementation of this WQIP. The officer was to research and develop recommendations for local governments to reduce contaminants entering the catchments of the Swan and Canning rivers through the review of: local government approvals, local laws, local government policies, and capacity building programs Templates and examples for other local governments were made available at the time.	
		2.2.2 Encourage uptake and participation in the Small Factory Environmental Management Support Program	SERCUL	CoC, DWER, DER	• Opportunities for uptake of the Small Factory Environmental Management Support project were pursued on a LGA scale. SERCUL tried to pursue this project implementation at a State-wide level. The 2015-17 Light Industry Program takes on some of the priorities and approaches identified in this program.	
3. Reduction Source control	**3.1** Apply best management practice for nutrient management	**3.1.1** Ensure developers, builders and landscapers implement best management practices to control erosion and sedimentation to protect waterways	DBCA, SERCUL, CoC, CoB,	WC, DWER, Perth NRM	• The Sediment Taskforce was established in 2014. Member organisations contributing to the Taskforce include DBCA, City of Armadale (CoA), City of Gosnells (CoG), City of Kwinana (CoK), WALGA, Master Builders Association (MBA), Housing Industry Association (HIA), Urban Development Industry of Australia (UDIA), DWER, SERCUL, Main Roads WA, WC, Department of Housing. Taskforce administered by Perth NRM (with funding from DBCA to 2018).	

					• A two-year research project is underway supervised by UWA Professor Carolyn Oldham through the CRC for Water Sensitive Cities to quantify sand/soil loss from subdivisions and individual dwellings during the construction phase. The research is funded jointly by member organisations of the Sediment Task Force. CoA and CoG have also provided assistance to the student to find suitable test sites. The Heron Park estate in Armadale is to be a case study site. The findings will potentially support sediment reduction promotion and enforcement. • The previous Sediment and Erosion Project was delivered in the period 2009 to 2012. A consultant was engaged to complete a detailed investigation into planning, statutory and policy mechanisms for controlling and enforcing management of erosion and sedimentation, resulting in the report *Essential Environmental 2010, Southern River Sediment and Erosion Project Report, prepared for the Swan River Trust, March 2010*. • A Sediment and Erosion Project Officer was employed, housed at the City of Gosnells, from June 2010 to July 2012 and reviewed and made recommendations on the most appropriate mechanisms for sediment control, using six case studies as an example, across the Cities of Armadale and Gosnells.	
		3.1.2 Establish a working group to develop procedures to determine management responsibility for nutrient contamination from past development in accordance with the *Contaminated Sites Act 2003*	DBCA, DER	CoC, CoB. SERCUL	• Act has been reviewed. Nutrient contamination alone is not enough to trigger the Contaminated Sites Act if the nutrient contamination was caused by lawful use of fertilisers or previously unregulated use of fertilisers in accordance with manufacturers recommendations, unless there is a land use change since that time.	

		3.1.3 Where practical create vegetated buffer zones/verges and implement WSUD principles between waterways and turf within council reserves to assist prevention of herbicides, fertilisers and grass clippings entering waterways	CoC, CoB	SERCUL	• DNIP projects in the catchment have created buffer zones between some grassed parkland and natural landscapes. • Major Hydrocotyl eradication program to assist revegetation sites downstream. Major control program undertaken at Liege Street Wetland and other sites for Amazon Frogbit. • CoB- Historical restoration work at Noble Park (WC compensating basin) has resulted in a vegetated buffer around basin.	
		3.1.4 Develop and implement Nutrient and Irrigation Management Plans (NIMPs) for public open space and school reserves	CoC, CoB, Department of Education and Training	DWER	• CoC has NIMPs implemented for streetscapes and enforce NIMP on developments. CoC undertake soil testing at all of the parks to ensure only the nutrients required for optimal turf growth is applied, reducing the risk that excess nutrients are applied. • CoB nutrient management practices for managed parks located within the catchment (ie. Cottage Park Lake, Peachey Park, Nance Park) reviewed against recommendations of Annual Nutrient Survey run by SERCUL as part of the Phosphorous Awareness Project. • Fertilise Wise Training (run by SERCUL, funding from DBCA) is available to school grounds keepers.	
		3.1.5 Maintain street sweeping program and develop monitoring plan to assess efficiency of current schedules and future procedures	CoC, CoB		• CoB - Street sweeping undertaken every two months. • CoC – Street sweeping is routine rather than strategic but the purpose is to reduce leaf litter and gross pollutants in the system. Before and after photos are taken of the drain cleaning works.	

4. Amelioration Conveyance and transmission	**4.1** Improve urban drainage design and support structural nutrient intervention	**4.1.1** Increase bio filtration treatment and retention time at high nutrient sites	CoC, CoB, DBCA	DWER, WC	• DNIP projects - Manley St Basin Improvements, Anvil Way Living Stream, Liege St Wetland and Wharf St Wetland developed and/or maintained throughout the catchment to remove contaminated sediment, treat low flows using filter media and improve water quality through vegetated swales and increased retention times. Canning Plain DNIP projects are implemented through partnerships between DBCA, CoC, SERCUL, DWER and WC. • CoC undertakes maintenance of DNIP sites and has also implemented environmental improvements at Station Street Wetland and Maniana Wetland (Queens Park Wetland). • Some site prioritisation during the Urban Waterways Renewal (UWR) futures project was completed by SERCUL.	
		4.1.2 Continue Canning River Restoration project to address nutrient export using foreshore restoration	SERCUL, Perth NRM	DBCA	• The Canning River Regional Park is likely to be expanded as outlined in Draft Action Plan H: Conservation Program of the Draft Perth and Peel Green Growth Plan for 3.5 million (Strategic Conservation Plan). • Amazon Frogbit control and monitoring continuing. • Canning River Regional Park post fire recovery project - The Swan River Trust invested close to $100,000 into Canning River Regional Park at the end of the Canning Plains Catchment after a destructive fire in the summer of 2011. The aim was to reduce erosion and improve regeneration and restoration of foreshore areas. The quick response after the fire by the Trust and SERCUL meant that on ground projects were very effective at preventing re-infestation by weeds and successful revegetation and natural recruitment of native species in the area was extensive. Transect and photo point monitoring over the course of the project has occurred. • DBCA's Riverbank Program has partnered with CoC for erosion control works along Wilson Park and Kent St Weir foreshore, Riverton Bridge and Kiosk Point and Eco Education Centre demonstration site. • The Wilson Wetland Action Group is a community group that	

					works to restore the Wilson Wetlands at the downstream end of the Mills Street Main Drain, within the Canning River Regional Park. The group has received grant funding for equipment, plants and weed contractors over the years but primarily achieves its restoration goals through volunteer time. • Swan Alcoa Landcare Program (SALP) grants have supported foreshore restoration projects in the Canning River Regional Park for many years.	
		4.1.3 Maximise retrofitting of stormwater management systems to achieve improved water quality outcomes	CoC, CoB	DWER, WC	• For 11 years, the Swan River Trust (and now DBCA) and its partners have invested substantial resources in constructed wetland systems as part of the Swan Canning Clean-up Program and then the Healthy Rivers Action Plan (HRAP) to protect water quality of the Swan Canning river system. The Wharf Street Constructed Wetland and Civic Parkland project was initiated under the Drainage and Nutrient Intervention Program (DNIP) through a partnership arrangement between the Trust, the CoC and SERCUL. The 1ha wetland intercepts stormwater from the Wharf Street Main Drain which delivers stormwater from a 129-hectare urban area within the Canning Plain Catchment, to the Canning River just upstream of the Kent Street Weir, an area historically subject to de-oxygenation and occasional fish kill events. The wetland is designed to remove nutrients and other pollutants from stormwater as it passes through a series of vegetated and open water surface flow and subsurface flow compartments with high flows bypassing the wetland. Key project objectives were about improving water quality and habitat, providing a demonstration site; providing a passive recreation and education asset and link between the Canning River Regional Park and the Canning Council Offices. UWA, through the CRC for Water Sensitive Cities (CRC WSC) used the Wharf Street Wetland to better understand the function of constructed wetlands under Western Australian conditions and have	

					recently completed a review of six years of data. Results show that during that time the wetland has prevented 1,660kg of nitrogen and 130kg of phosphorus entering the Canning River. The Wharf Street Wetland was the winner of Stormwater WA's Award for Excellence in Research and Innovation in 2015. • Located in the Mills Street main drain catchment, the Anvil Way Compensation Basin and Living Stream Project saw a 0.9ha compensation basin, in an industrial area, restored into a vibrant living stream through removal of contaminated sediment, reshaping and revegetation. The project is also being used as demonstration site by the CRC WSC to better understand living stream function in areas of surface groundwater interaction. Results from this assessment have shown that the sediments have a store of approximately 2 tonnes of phosphorus, 17 tonnes of nitrogen and 164 tonnes of total organic carbon and the vegetation has a store of at least 140kg of phosphorus and 660kg of nitrogen. Up to 50% of Aluminium, Copper, Iron, Lead and Zinc was shown to have been attenuated. • The Manley Street bio-retention system has also been trialled in a compensating basin in the upstream section of the Wharf Street main drain. This project which was constructed in 2007 sees diversion of low flows from the basin inlet into a vegetated infiltration trench and bund made of laterite (to remove soluble phosphorus) and a sand saw dust (to encourage de-nitrification). The project was assessed by UWA in 2011 and it showed that the system was successfully removing nutrients although mass of nutrient removal could not be quantified, given the impact of the overall influence of the larger basin nutrient flux. Since construction of this demonstration project the City of Canning has also used the concept of a bio-retention system with a similar design as the basis for another compensation basin retrofit project at Tarun Court within the same catchment. Maintenance and monitoring of these project sites is continuing.	

					• The Liege Street Wetland was built before the WQIP development and captures and treats stormwater from the Liege Street and Cockram Street main drains. The DBCA DNIP, the CoC and SERCUL continue to monitor and maintain this constructed wetland. • CoC has also implemented environmental improvements at Station Street Wetland and Maniana Wetland (Queens Park Wetland).	
5. Treatment-Reuse-Disposal	**5.1** Achieve zero nutrient contribution from sewage	**5.1.1** Full connection of existing industrial and residential areas where a sewerage scheme is available	State and local government	WC	• A process for enforcing connection to sewer, where available, was investigated as part of the Canning Plain WQIP investment project for light industry land use, however no feedback has been received as to whether any forced connections using existing mechanisms. • One of the deliverables of the 2015-17 Light Industry Program is for DWER to research options available to local governments to enforce connection to sewer and to make recommendations. There have been some connections to sewer by businesses as part of the auditing process where there was inappropriate use of stormwater drains.	
		5.1.2 Manage wastewater scheme to reduce spills to the environment	WC		• WC has made significant investment in reducing wastewater spills to the environment.	
		5.1.3 Advocate for infill sewage to be extended throughout industrial areas eg. Kewdale and Welshpool	CoC, CoB	SERCUL	• These areas are not currently on the State Government Infill Sewerage Program, administered by the WC. No information supplied on any advocating.	
	5.2 Promote urban drainage initiatives	**5.2.1** Encourage the use of structural controls to address litter, sediment and vegetative materials at source	CoC, CoB	DWER	• The DWER Stormwater Management Manual for Western Australia encourages structural controls amongst other stormwater management strategies. • The DNIP installed gross pollutant traps (GPTs) Liege Street Wetland, a trash rack at the Wharf Street Wetland and hydrocarbon traps at the Anvil Way Living Stream and Liege St Wetland.	

		5.2.2 Adopt or maintain regular cleaning of gullies and stormwater pollutant traps to enable pollution spills to be contained and educted prior to entering the waterways			• CoB – drains educted every five years – standard infrastructure includes grated gully pits, side entry chutes, manholes with standard lid and manholes with standard gatic lid. No stormwater pollution traps managed by the CoB. • The gross pollutant traps (GPTs) at the Liege Street Wetland, a trash rack at the Wharf Street Wetland and hydrocarbon traps at the Anvil Way Living Stream and Liege St Wetland are maintained in accordance with the project maintenance plans.	