City of Busselton

Geographe Bay

Council Agenda

22 May 2019

ALL INFORMATION AVAILABLE IN VARIOUS FORMATS ON REQUEST

city@busselton.wa.gov.au

CITY OF BUSSELTON

MEETING NOTICE AND AGENDA – 22 MAY 2019

TO: **THE MAYOR AND COUNCILLORS**

NOTICE is given that a meeting of the Council will be held in the the Council Chambers, Administration Building, Southern Drive, Busselton on Wednesday, 22 May 2019, commencing at 5.30pm.

Your attendance is respectfully requested.

DISCLAIMER

Statements or decisions made at Council meetings or briefings should not be relied on (or acted upon) by an applicant or any other person or entity until subsequent written notification has been given by or received from the City of Busselton. Without derogating from the generality of the above, approval of planning applications and building permits and acceptance of tenders and quotations will only become effective once written notice to that effect has been given to relevant parties. The City of Busselton expressly disclaims any liability for any loss arising from any person or body relying on any statement or decision made during a Council meeting or briefing.

NAOMI SEARLE

A/CHIEF EXECUTIVE OFFICER

10 May 2019

CITY OF BUSSELTON

AGENDA FOR THE COUNCIL MEETING TO BE HELD ON 22 MAY 2019

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13.1 ADOPTION OF FINAL WATERWAY MANAGEMENT PLANS FOR THE LOWER VASSE RIVER AND TOBY INLET

SUBJECT INDEX:	Vasse Geographe Strategy
STRATEGIC OBJECTIVE:	The health and attractiveness of our waterways and wetlands is improved to enhance community amenity.
BUSINESS UNIT:	Environmental Services
ACTIVITY UNIT:	Environmental Management
REPORTING OFFICER:	Senior Sustainability/Environment Officer - Mathilde Breton
AUTHORISING OFFICER:	Director, Planning and Development Services - Paul Needham
VOTING REQUIREMENT:	Simple Majority
ATTACHMENTS:	Attachment A Lower Vasse River Waterway Management Plan Attachment B Toby Inlet Waterway Management Plan Attachment C Your Say Busselton - Lower Vasse River Waterway Management Plan Survey Attachment D Your Say Busselton - Toby Inlet Waterway Management Plan Survey Report Attachment E Proposed changes to the Lower Vasse River Waterway Management Plan

PRÉCIS

This report presents final Waterway Management Plans (WMPs) for the Lower Vasse River and Toby Inlet, prepared by the City as part of the Revitalising Geographe Waterways (RGW) program and outlines feedback received during the public consultation period.

BACKGROUND

The health of the Lower Vasse River and Toby Inlet are of significant concern to our community. Physical modifications, altered flow regimes, nutrient enrichment and sedimentation are serious issues in these waterways, impacting ecology and public amenity. The Lower Vasse River experiences algal blooms every summer, dominated by harmful blue-green algae. Toby Inlet has large accumulations of sediments, and is prone to macroalgal blooms due to poor water quality.

An independent review of waterways management in the Geographe Bay Catchment in 2014 highlighted the lack of a lead management body and comprehensive management planning for key water assets. The review led to the formation of the Vasse Ministerial Taskforce and the RGW program, which focuses on improving water quality in key water assets. As part of the RGW program, the City committed to preparation of WMPs for the Lower Vasse River and Toby Inlet. These are two of 30 projects being undertaken as part of the RGW program.

The draft WMPs were endorsed by Council for public advertising on 12 December 2018. Draft WMPs are attached as Attachments A and B.

The RGW program requires that the WMPs are completed by June 2019.

STATUTORY ENVIRONMENT

The Lower Vasse River and Toby Inlet waterways are mostly Crown Land with no designated manager. The only exception is a 2.5km section of the Toby Inlet water body at the most downstream end, which is in reserves managed by the City. The City also manages a number of foreshore reserves adjacent to both the Lower Vasse River and Toby Inlet.

The *Rights in Water and Irrigation Act 1914* (RIWI Act) concerns the management of watercourses, and the Department of Water and Environmental Regulation is the agency responsible for implementation of the RIWI Act. In part, the objects of the RIWI Act are -

a) to provide for the management of water resources, and in particular-

(i) for their sustainable use and development to meet the needs of current and future users; and

(ii) for the protection of their ecosystems and the environment in which water resources are situated, including by the regulation of activities detrimental to them;

The RIWI Act includes provisions to control interference with watercourses, which will apply to future implementation of the WMPs in regards to works that involve changes to the bed, banks and flow of these systems.

Other legislation that may apply to future implementation of some on-ground works components of the WMPs are:

- *Aboriginal Heritage Act 1972* (WA)
- *Fish Resources Management Act 1994* (WA)
- *Wildlife Conservation Act 1950* (WA)
- *Biodiversity Conservation Act 2016* (WA)
- *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)

RELEVANT PLANS AND POLICIES

In 2016 Council adopted the Environment Strategy 2016 – 2021 with objectives for 'Water Resources' that include:

- To ensure proactive management of water assets within the Geographe catchment.
- To provide opportunity for the community to engage with and learn about water assets, and
- practical ways to minimise impacts at the individual level.

The Environment Strategy 2016-2021 also identifies the following relevant strategic actions:

- Strategic Action 2.1 - Prepare management plans for the Lower Vasse River and Toby Inlet in close consultation with the local community and stakeholders.
- Strategic Action 2.2 - Continue to work with partners of the Vasse Taskforce to develop strategic and integrated approaches to management of Water Quality in the wetlands and waterways of Geographe catchment.

FINANCIAL IMPLICATIONS

Implementation of minor management actions in the WMPs is expected to be undertaken as part of the existing Environmental Services budget.

LONG-TERM FINANCIAL PLAN IMPLICATIONS

There may be Long Term Financial Plan implications with implementing the WMPs. In particular, pursuing the 'Living Streams' approach outlined in the WMP for the Lower Vasse River would potentially require significant investment, in excess of $2M. It would see staged works to alter the physical environment and undertake ecosystem restoration to create conditions less favourable to algal blooms. Further research and planning is required before more specific financial implications can be tabled.

STRATEGIC COMMUNITY OBJECTIVES

The recommendation in this report links to Key Goal Area 3 – Environment of the City's Strategic Community Plan 2017 and specifically the following Community Objective/s:

3.2: Natural areas and habitats are cared for and enhanced for the enjoyment of current and future generations; and

3.3: The health and attractiveness of our waterways and wetlands is improved to enhance community amenity

The WMPs also align directly with Strategy 3f of the Strategic Community Plan:

> *Continue to work with key partners to improve the health of the waterways in the Geographe catchment.*

The consultation process for the Strategic Community Plan 2017 identified waterways management as a priority issue for the community, particularly improving management of the Lower Vasse River.

RISK ASSESSMENT

An assessment of the potential implications of implementing the Officer Recommendation has been undertaken using the City's risk assessment framework. The assessment identifies 'downside' risks only, rather than 'upside' risks as well. Risks are only identified where the individual risk, once controls are identified, is medium or greater. No such risks have been identified.

CONSULTATION

Consultation to develop draft WMPs

Extensive community consultation has been completed as an integral part of the planning process for the WMPs. This has included:

- Community information events "Focus on Toby Inlet" and "Focus on the Lower Vasse" to share information and identify key issues for community June 2015.
- Series of interviews to gather in-depth information regarding future management of both waterways March 2016.
- Community Views events in March 2016 to identify and rate management issues, valued characteristics and desired change.
- Public workshops to develop vision and management objectives February 2017.
- Formation of Community Reference Groups (CRG) for each WMP, by inviting membership from attendees to initial consultation sessions. With representation from the City, Department of Water and Environmental Regulation, and GeoCatch.

- CRG workshops to review and refine vision and management objectives April 2017.
- Presentation of draft management objectives to South West Boojarah Working Party May 2017.
- Public community update to review draft management objectives, and to present outcomes of RGW hydrological modelling June 2017.
- "Your Say" community survey on re creational activities for Toby Inlet.
- Update on progress to the South West Boojarah Working Party November 2017.
- Aboriginal Heritage Survey consultation bus tour of key sites February 2018.
- CRG workshops to develop management strategies and actions March 2018.
- Presentation of WMPs to Vasse Taskforce and review of management strategies and actions by Taskforce members and member agencies August 2018.
- Review of management strategies and actions by Project Team, with key stakeholder representatives, August 2018.
- Presentation of draft management strategies and actions to South West Boojarah Working Party October 2018.
- Review of working drafts of the WMPs by the CRG and Vasse Taskforce members October 2018.
- Ongoing representation on the Vasse Taskforce by staff and councillors 2016-2019.
- Consistent meetings of the Lower Vasse River and Toby Inlet Project Team, with representatives from City of Busselton, Department of Water and Environmental Regulation, GeoCatch, Water Corporation, Busselton Water, Department of Biodiversity, Conservation and Attractions.

The outcomes of consultation were used continually to develop the draft WMPs. Consultation provided direct input to visions, identifying and rating management issue, developing draft management objectives, and in developing management strategies and actions.

Public advertising of draft WMPs

The draft WMPs for the Lower Vasse River and Toby Inlet were advertised for public comment from 16 January to 27 February 2019. Public information sessions were also held on 19 February 2019 for the Lower Vasse River and on 11 February 2019 for Toby Inlet. 17 people attended the Lower Vasse River information session and 15 people attended the Toby Inlet information session. Positive feedback was provided, with minor comments noted.

The community was invited to complete a survey via the City's online public consultation platform Your Say Busselton. 11 submissions were received for the Lower Vasse River and 6 submissions for Toby Inlet. There was general support for the information contained in the draft WMPs and the strategies proposed. Reports with detailed responses to the surveys are listed as Attachments C and D.

Four additional written submissions (three for the Lower Vasse River and one for Toby Inlet) were also received. These provided additional information towards implementing the recommended draft strategies.

Comments were reviewed and informed minor modifications to the draft WMPs.

Once adopted by Council, the final WMPs will be presented to the Vasse Taskforce in June 2019.

OFFICER COMMENT

Feedback from Your Say Busselton

Advertising of the draft WMPs through Your Say Busselton did not attract a large number of responses (11 for the Lower Vasse River and 6 for Toby Inlet). This is understood to be mostly due to the fact that extensive community and stakeholders consultation was undertaken prior to finalising the drafts. The feedback received should therefore be considered as a snapshot and is not necessarily reflective of the general community.

Most respondents agree that the WMPs are comprehensive documents (LVR 63.6% and TI 66.7%), recommending valuable management strategies and actions (LVR 54.5% and TI 83.3%) and clearly outlining future management of the waterways (LVR 36.4% and TI 66.7%).

Most respondents see the City as being the lead agency for managing the waterways. This is particularly prevalent for the Lower Vasse River (LVR 72.8% and TI 33.4%)

Over half of respondents (54.5%) are supportive of the Living Streams approach to managing the Lower Vasse River while 18.2% would only support minor physical change and additional planting and 18.2% would support sediment removal only. A small minority (9.1%) is not supportive of any changes to the river.

With regards to funding, a large proportion of respondents (LVR 54.5% and TI 33.3%) feel that the City should increase investment significantly and use this to seek more external funding, with others preferring the sourcing of external funding (LVR 27.3% and TI 66.7%) and using existing funding (LVR 18.2%).

Questions 8 to 23 asked for feedback on specific management strategies listed in the WMP. These were optional questions and only attracted partial responses. Levels of supports ranged from 70% to 100% for the Lower Vasse River. Toby Inlet results are not presented as only two people responded. People were also invited to provide any additional comments.

Written submissions

Four additional written submissions (three for the Lower Vasse River and one for Toby Inlet) were also received.

The submissions on the Lower Vasse River mainly provided additional information towards implementing the recommended draft strategies, in particular with in-situ treatment of water quality (including aeration, vegetated floating islands, oxygenation, algaecide, the use of bacteria and enzymes and ultrasonic control).

Minor modifications are proposed to the LVR WMP to address these concerns but most of these issues will be further explored when planning for implementing the recommended actions of the WMPs, in particular the Living Streams approach.

It is not practical to show the proposed modifications in tracked changes due to the structure of the WMP having been altered. The bulk of the changes were made under section 4.3 Water Treatment of the LVR WMP. Appendix E shows the advertised version and the final version of this section to facilitate viewing the proposed changes.

The written submission on Toby Inlet provided further information on the need to determine sediment composition, location and sources, which will be looked at in any sediment removal investigations for Toby Inlet as recommended in the WMP. As such, no modifications are proposed.

WMPs implementation

The WMPs do not include immediate commitments to implementation specific management actions, but rather provide a framework for implementation that defines the roles and responsibilities of key stakeholders and outlines a process for action planning, works, evaluation and reporting. This will allow ongoing prioritisation and implementation of actions in line with available funding, and building of new information from research, monitoring and outcomes as management progresses.

Works are already underway to implement some management actions of the WMPs, in particular control of Mexican Waterlily and installation of updated interpretative signage. Further planning is also occurring to further develop the 'Living Streams' approach.

CONCLUSION

The completion and endorsement of the WMPs is a significant milestone in working towards improving the long-standing issue of poor water quality in our catchment. It also completes the last milestone for two projects of the RGW program for the City, due by June 2019. It concludes three years of extensive planning and consulting with stakeholders and the community and provides the City with a comprehensive and detailed roadmap for better managing the natural and cultural values of our local waterways.

It is important momentum is not lost and the City continues with progressing implementation of management actions where possible. It is also recognised other management actions will require further planning and additional funding before they can be implemented.

OPTIONS

The Council could request additional changes to the final WMPs before endorsement.

TIMELINE FOR IMPLEMENTATION OF OFFICER RECOMMENDATION

The final WMPs will be made available to the public by posting on the City of Busselton website within a month of the Council Decision. Actions of the WMPs will be implemented as resources and funding permit.

OFFICER RECOMMENDATION

That the Council resolves to adopt the following as guides to future planning:

1. The Lower Vasse River Waterway Management Plan (Attachment A); and

2. The Toby Inlet Waterway Management Plan (Attachment B).

Department of Water and Environmental Regulation
Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Lower Vasse River Waterway Management Plan

May 2019

City of Busselton
Geographe Bay

Revitalising Geographe Waterways

VASSE taskFORCE

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Acknowledgement of Wadandi people and country

The Vasse River has great spiritual, environmental, customary and social significance to the Wadandi Nyungar people. From its headwaters at Chapman Hill through to the Vasse-Wonnerup Wetlands, the Bilya (river) carries their songline. The Wadandi people are the traditional custodians of the Lower Vasse River, and this connection will be recognised in its future management.

All systems and beliefs have water as life, blood. We can't survive without fresh water: it's blood, life.

(Isaac Webb, 2018, cited in BGA 2018)

Executive Summary

Background

The Lower Vasse River is a reach of the Vasse River approximately 5.5km in length from the Vasse Diversion Drain to the weir structure at the Old Butter Factory. It flows through the centre of Busselton, about 250km south of Perth. This reach is greatly modified, with an estimated 90% of catchment flows diverted to Geographe Bay, and impoundment by the weir structure at its downstream end. The river is highly eutrophic, with severe algal blooms occurring each year during the warmer months.

Isolation in terms of flow; the conditions of extremely poor water quality experienced; and the high-profile location have led to the need for specific management of this area. This is the focus of this Water Management Plan. It was initiated though the Revitalising Geographe Waterways program, in response to community concerns about water quality issues in key water assets in the Geographe Bay Catchment. The Water Management Plan has been developed using a collaborative approach that has allowed for extensive consultation to work towards future management of the Lower Vasse River that aligns with community priorities, is well-understood and accepted, and has significant commitment to implementation by stakeholders.

Purpose and scope

The City of Busselton (the City) has developed this Waterway Management Plan (WMP) to guide future management strategies and actions that will work towards the vision for the Lower Vasse River:

> *The Lower Vasse River is an icon of Busselton, valued and enjoyed by the community, as a healthy waterway linking people and nature.*

The Plan includes a description of the characteristics and management issues for the Lower Vasse River, and provides objectives for the future. Through a review of available management options and consideration of stakeholder input, a comprehensive series of management strategies, each with specific actions, has been developed to guide works that will contribute to the objectives and overall vision for The Lower Vasse River.

Management focus areas

Management issues for the Lower Vasse River have been grouped into the following seven focus areas, with 16 associated management objectives, summarised here in order of importance as rated during community consultation. The table below provides management strategies and actions for each focus area.

1. Water Quality

Nutrients are a key driver of algal blooms, so ongoing load reduction actions are a fundamental part of management. However, it often takes a long time to achieve load reductions, and they may be counteracted by new developments and changes to land use. Algal blooms can also be addressed through interventions that limit nutrient availability or directly target algal blooms. They may also be managed by creating less favourable physical conditions for phytoplankton; or restoring ecosystem functions such as nutrient cycling and food web processes.

Objectives:

- Reduce nutrient contributions to the Lower Vasse River from all existing sources to improve water quality and reduce the frequency and severity of toxic algal blooms.
- Minimise any additional nutrients flowing into the Lower Vasse River from new developments and agricultural intensification.
- Utilise science and innovative technologies to improve water quality in the Lower Vasse River.

2. Ecology

Although degraded, the Lower Vasse River still provides habitat for native freshwater fish, frogs, turtles and invertebrates, and open water areas for waterbirds. The riparian vegetation contributes to aquatic habitats and also supports a range of terrestrial fauna and birds. The permanent fresh waters of Lower Vasse River provide a unique habitat in a landscape of seasonal wetlands and estuaries. There is significant scope to enhance ecological values through managing invasive species and restoring habitat.

Objectives:

- Protect and enhance native aquatic and terrestrial habitats in the Lower Vasse River and the foreshore reserve.
- Reduce the impact of threatening processes on the natural values of the Lower Vasse River and the foreshore reserve.
- Balance mitigation of fire risks with the protection of natural values of the Lower Vasse River foreshore reserve.

3. Water Flow

There have been substantial changes to the hydrology of the Lower Vasse River and its catchment through physical changes, diversion and impoundment. There is a strong perception in the community that increasing flows from the Vasse Diversion and removal of the Butter Factory weir boards will improve water quality and mobilise sediments. This approach is limited by flow regimes, flood risks and influence on nutrient loads; and a lack of defined management responsibilities for operation of flow control infrastructure.

Objective:

- Optimise water flow in the Lower Vasse River to balance improvement of water quality, protection of natural values and public amenity, while maintaining flood protection.

4. Sediments

The Lower Vasse River system has accumulated a layer of nutrient rich organic sediments, which contribute nutrients to the water column over summer, driving algal blooms. These sediments provide habitat for beneficial aquatic plants and benthic invertebrates. Sediments are therefore are a key consideration in addressing water quality problems in the Lower Vasse.

Objectives:

- Strategically manage accumulated sediments to protect the natural, cultural and social values of the Lower Vasse River.

5. Amenity, Recreation and Education

A number of trails and public open space areas adjoin the Lower Vasse and these are still regularly used by the community. Poor water quality has greatly reduced the opportunities for recreational activities in and around the river during the warmer months. Access and recreation was rated the highest and the focus area requiring change. There is significant potential for improving amenity and recreational and educational opportunities through enhancing ecology, improving facilities, addressing water quality problems, and developing information material.

Objectives:

- Improve visual amenity, public health and odours for residents and visitors to enjoy the Lower Vasse River.
- Facilitate recreational and educational opportunities, which are compatible with protection of the key values of the Lower Vasse River and enhance community stewardship.
- Enhance public access to the Lower Vasse River and within the foreshore reserve, with a focus on creating linkages to the town centre and surrounding areas while protecting the river's natural values.

6. Culture and Heritage

The river has historically been an iconic feature of the town and focal point for recreational and social events. There is a strong Aboriginal cultural connection to the river and a need for greater recognition of the role of Aboriginal people in future management.

Objective:

- Promote understanding of the Aboriginal and European history and culture of the Lower Vasse River.

7. Governance

The need for a designated manager of the Lower Vasse River was recognised by the independent review of waterways management, and also highlighted during community consultation. The lead role of the City in the future management of the Lower Vasse River will be recognised through endorsement and adoption of this WMP. This will task the City with responsibility for coordinating implementation, however key stakeholders and the community will have ongoing roles in many aspects of the WMP.

Objectives:

- Develop and maintain partnerships and a collaborative approach between key stakeholders and the community when managing the Lower Vasse River.
- Maximise opportunities for protection of the Lower Vasse River as part of future development proposals and changes in land uses.
- Manage the Lower Vasse River with consideration to other water assets, including the Vasse-Wonnerup Wetlands and Geographe Bay.
- Improve knowledge and understanding of key values and management issues of the Lower Vasse River to support adaptive management.

Living Streams

This WMP recommends further development of a Living Stream approach to future management of the Lower Vasse River. The term *Living Streams* describes an approach to managing urban stormwater that creates a complex ecosystem with outcomes for ecology, water quality, water conveyance and amenity. For the Lower Vasse River, this would involve altering the morphology to restore ecological processes and create physical conditions that provide greater resilience to high nutrient conditions. It may also facilitate intervention actions, such as water treatment and sediment removal, in specific areas of the river.

Implementation

The lead role of the City in the future management of the Lower Vasse River will be recognised through endorsement and adoption of this WMP. Other key stakeholders will continue to have important roles in many aspects of implementation, and there is an ongoing need for community reporting and feedback.

There are many management actions recommended in the WMP and currently there is no guaranteed funding mechanisms or timeline for implementation. A framework for implementation is provided that defines the roles and responsibilities of key stakeholders and a process for action planning, works, evaluation and reporting. This will allow ongoing prioritisation and implementation of actions in line with available funding, and building on new information from research, monitoring and outcomes as management progresses.

Implementation process for the Lower Vasse River Waterway Management Plan:

Management strategies and actions for the Lower Vasse River.

Strategies and actions are grouped for the Living Streams approach (LS) and each focus area: Water Quality (WQ); Ecology (E); Water Flow (WF); Sediments (S); Amenity; Recreation and Education (ARE); Culture and Heritage (CH); Governance (G).

Management Strategies	Management Actions
Living streams approach	LS.1 Continue to develop Living Streams planning as a pathway for implementing ecological restoration and water quality improvement works, and assess community support for this approach. LS.2 Incorporate the key principles into restoration planning as part of the Living Streams approach.
Protecting water quality from urban sources	WQ1.1 Quantify nutrient and pollutant exports from Busselton Light industrial area (LIA) to the Lower Vasse River to inform a case for deep sewerage. WQ1.2 Explore options to secure deep sewerage for the Busselton LIA in partnership with Water Corporation. WQ1.3 Assess opportunities for greater connection to existing sewerage infrastructure within the LVR catchment. If there a significant opportunity exists, investigate options and incentives to increase connectivity. WQ1.4 Planning decisions to include appropriate sewerage management requirements and best practice water management, through implementing the *Better Urban Water Management* framework. WQ1.5 Develop a prioritised program for stormwater upgrades to maximise nutrient reduction outcomes. WQ1.6 Support educational campaigns that aim to reduce nutrients in runoff through individual and community actions (e.g. Bay OK). WQ1.7 Support implementation of the Vasse-Wonnerup Wetlands and Geographe Bay Water Quality Improvement Plan (WQIP).
Reducing nutrient inputs from the rural catchment	WQ2.1 Support projects focussed on reducing nutrient exports from rural catchment of the LVR, as recommended in the Vasse-Wonnerup Wetlands and Geographe Bay WQIP (DoW 2010; noting future updates of this document): WQ2.2 Explore opportunities for enhanced nutrient assimilation in rural drains in the LVR catchment, particularly those in reserves.
Water treatment	WQ3.1 Incorporate outcomes from the Water Quality Treatment Trials (2016-2018) into future management planning. WQ3.2 Undertake seasonal water treatments in priority amenity area/s prior to algal bloom establishment, ensuring physical isolation to maximise effectiveness (dependent on outcomes Water Quality Treatment Trials, 2016-2018). WQ3.3 Maintain research partnerships to identify and investigate new technologies to treat water in the future.
Riparian vegetation management	E1.1 Develop and implement a revegetation program for City-managed foreshore reserves, considering recommended rehabilitation areas reported in Ecoedge (2017). E1.2 Continue to impose appropriate conditions on new developments adjacent to the Lower Vasse River that ensure future vesting and revegetation of foreshore reserves. E1.3 Include creation and improvement of habitat for birds and possums in planning riparian revegetation. E1.4 Update the Vasse River Action Plan in partnership with adjacent landholders, and extend this throughout the Lower Vasse River study area.

	E1.5	Minimise fire risks associated with foreshore reserves by: reducing growth of annual grassy weeds; and considering species type, height and planting density when planning revegetation.
Understanding and protecting waterbirds	E2.1	Undertake a survey of waterbirds of the Lower Vasse River and identify important habitat zones, with strong involvement from the community.
	E2.2	Protect identified important bird habitat zones through revegetation and weed control, recognising the current role of weeds as habitat.
	E2.3	Create additional habitat zones for birds by placing large woody debris emerging from the water.
	E2.4	Avoid identified important bird habitat zones when planning future infrastructure, and consider nesting season when planning works.
Controlling invasive species	E3.1	Prevent of further spread of Mexican waterlily through herbicide control and/or shading.
	E3.2	Undertake strategic control of Mexican waterlily to progressively reclaim areas of open water, while minimising adverse impacts and preventing a return to algal blooms in these areas.
	E3.3	Undertake regular feral fish eradication activities in partnership with Murdoch University.
	E3.4	Undertake targeted control of arum lily and Brazilian pepper trees throughout the Lower Vasse River study area.
Optimising flows	WF1.1	Increase flushing of the river by installing a second 900mm culvert at outflow point from Vasse Diversion Drain, in accordance with recommendations from the Reconnecting Rivers Report (DWER 2018).
	WF1.2	Monitor impacts of increasing flows into the Lower Vasse River.
	WF1.3	Undertake intensive monitoring water quality in the Vasse Diversion to support operational guidelines for managing the culvert.
	WF1.4	Develop operational guidelines for the Vasse Diversion culvert that defines responsibilities and provides formal guidance for manipulation of the valve to maximise water quality benefits and minimise risk of flooding.
	WF1.5	Review function of the Butter Factory weir boards to inform their future use and need for replacement.
	WF1.6	Investigate potential for increasing internal circulation in the system during summer to reduce residence time for phytoplankton.
Sediment Removal	S1.1	Undertake a small-scale sediment removal project, using geotextile bags for dewatering and disposal, to assess cost and logistics of this approach.
	S1.2	Determine feasibility of disposal options for future sediment removal: landfill, composting, soil conditioner.
	S1.3	Depending on outcomes of small scale removal, undertake staged removal of sediments in the Lower Vasse River as a component of Living Streams design.
Improving facilities and information	ARE1.1	Review existing facilities and develop a concept plan for strategic pathways and viewing points that connect people with the river.
	ARE1.2	Update the interpretive signage around the river to provide information on of the history, ecology, hydrology and management of the Lower Vasse River.
	ARE1.3	Develop online and printed resources with interesting and important information on ecology, water quality, history and management of the Lower Vasse River.
	ARE1.4	Establish bird watching areas and hides in appropriate places with informational material.
	ARE1.5	Encourage opportunities for citizen science to contribute to understanding and appreciation of the Lower Vasse River.
Public health management	ARE2.1	Continue monitoring phytoplankton species and densities to inform public health notifications.

	ARE2.2	Review algal bloom warning sign protocol and prepare a communication program to inform the community when harmful algal blooms occur.
	ARE2.3	Develop a policy for use of recreational watercrafts in the Lower Vasse River, including consideration of public health constraints.
Recognising Wadandi custodianship	CH1.1	In partnership with Wadandi people, include reference to traditional custodianship of the waterways and land in development of information resources.
	CH1.2	Manage future access in a way that avoids additional disturbance and considers protection of potential sites of significance – however Wadandi activities such as fishing, camping, the gathering of bush foods and family recreational and educational activities, should not be restricted by implementation of this plan.
	CH1.3	Seek to improve partnerships with the Wadandi community to increase their involvement in the management, protection and restoration of the Lower Vasse River.
	CH1.4	Consult further with Wadandi representatives in regards to specific works which result from this plan.
	CH1.5	Support programs that engage the Wadandi community in implementation of works associated with this plan.
Preserving historical values	CH2.1	Identify and ensure appropriate maintenance of sites of historical importance.
	CH2.2	Develop interpretive material to increase understanding of local history, and to promote, appreciate and access historical sites.
Collaborative and adaptive management	G1.1	The City to consider securing management orders over the waterway and adjacent public lands in Lower Vasse River study area, to facilitate implementation of this plan.
	G1.1	Establish a Management Advisory Group comprised of representatives from the City, Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, Water Corporation, GeoCatch, Wadandi representatives, and other community representatives.
	G1.2	Continue water quality monitoring in the Lower Vasse River.
	G1.3	Ensure adequate monitoring and reporting of outcomes from management actions, and feedback results into future management actions.
	G1.4	Maintain and develop partnerships with research organisations to improve knowledge and management of the Lower Vasse River.
Optimising planning tools	G2.1	Improve clarity of planning approval requirements for changes to land use and new developments in the agricultural sector (e.g. horticulture, dairies, feedlots).
	G2.2	Assess future development proposals and changes of land-use on adjoining lands with consideration of impacts on the Lower Vasse River.
	G2.3	Include 50m wide foreshore reserves as part of future development adjacent to the river.

1 Introduction

The City of Busselton (the City) has developed this Water Management Plan (WMP) to recommend management actions that will lead to improved water quality and ecological health for the Lower Vasse River. The vision for the Lower Vasse River, developed for this Water Management Plan in partnership with the community and stakeholders, is:

> *The Lower Vasse River is an icon of Busselton, valued and enjoyed by the community, as a healthy waterway linking people and nature.*

1.1 Background to this Waterway Management Plan

The Lower Vasse River is a high profile waterway in Busselton, flowing through the entrance to the town centre, and is a strong part of local history. It has extremely poor water quality as a result of increased nutrient loads form the catchment and changes to hydrology. Seasonal blooms of harmful phytoplankton are a major concern for the community and management. The river has been greatly modified from its original state and ecological health has declined, however it remains an important freshwater habitat supporting aquatic fauna and waterbirds.

This WMP is part of Revitalising Geographe Waterways (RGW), a $15 million program encompassing 30 projects to improve water quality and ecosystem health in key water assets. Within the RGW program, the City was given responsibility to prepare WMPs for the Lower Vasse River and Toby Inlet. The Department of Biodiversity, Conservation and attractions was given responsibility to develop an Operational Plan for the Vasse-Wonnerup Wetlands system.

The RGW program is one of five focus areas of the Vasse Geographe Strategy, a State Government initiative to address water quality in the Geographe Bay catchment (Figure 1). The program also includes three projects directly related to the Lower Vasse River WMP: the Reconnecting Rivers hydrological modelling project; the stormwater upgrades project for Busselton; and water treatment trials in the Lower Vasse River.

The Vasse Geographe Strategy was initiated by an independent review of waterways management (Hart 2014), commissioned by the State Government in response to serious community concerns about water quality issues. The Vasse Geographe Strategy is overseen by the Vasse Taskforce, comprising representatives from:

- Department of Water and Environmental Regulation (DWER)
- City of Busselton (the City)
- Shire of Capel
- Geographe Catchment Council (GeoCatch)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Primary Industries and Regional Development (DPIRD)
- Department of Planning, Land and Heritage (DPLH)
- South West Catchments Council (SWCC)
- Water Corporation (WCorp)
- Busselton Water (BW)

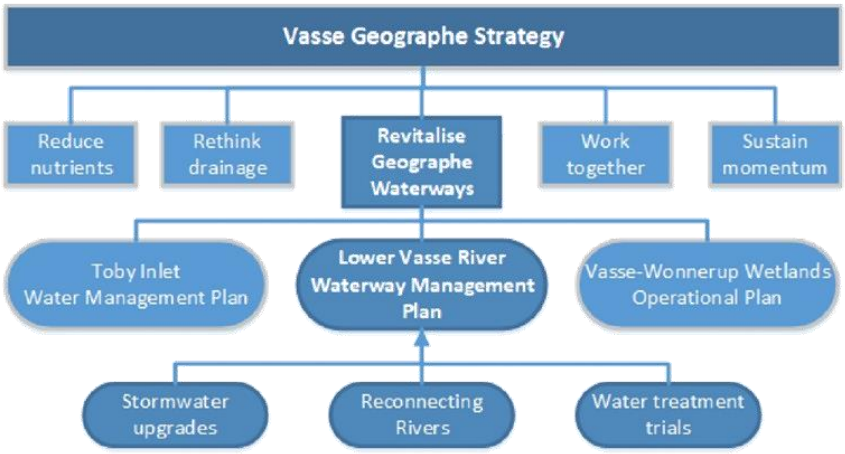

Figure 1. Framework for developing the Lower Vasse Waterway Management Plan.

1.2 Study area description

The study area includes the reach of the Vasse River approximately 5.5km in length, from the Vasse Diversion Drain to the weir boards at the Old Butter Factory, flowing through the centre of Busselton. The river discharges through a wetland area into the upper reach of the Vasse Estuary, which is part of the internationally significant Vasse-Wonnerup Wetland System. The study area includes the river itself and some adjacent areas of public land (Figure 1). Areas of water and unallocated crown land have no management responsibility designated, other areas are foreshore reserves managed by the City.

The lower section of the Vasse River is within Busselton's urban area, with a mix of residential and light industrial uses in the catchment. Upstream of the Busselton Bypass the surrounding land is agricultural, aside from the golf course. Upstream of the intersection with the Vasse Diversion, dairy and beef grazing are the dominant uses in the catchment and are intensifying.

The Vasse River catchment has ephemeral headwaters in the Whicher Scarp to the south, and lowland reaches crossing the Swan Coastal Plain. Extensive clearing and construction of the artificial drainage network during the early 1900s facilitated agricultural development across the Swan Coast Plain areas of the catchment. Native vegetation in these areas is very limited, and much of what remains is therefore of high conservation value. The upper parts of the catchment in the Whicher Scarp still retain substantial areas of remnant vegetation.

The Vasse Diversion diverts flow from approximately 90% of the Vasse River catchment to Geographe Bay. It was constructed in the early 1900s to provide flood protection for Busselton. Flow from this region of the catchment is restricted to a 900mmm pipe at the intersection, which may be open or closed by a manually-operated valve. This diversion drain physically separated the lower reach of the Vasse River, known as the Lower Vasse River, substantially changing the natural hydrological regime. At the downstream end of the study area the river is impounded by a weir, established in the early 1900s to maintain higher summer water levels through the town section for amenity and recreation

purposes. Removable weir boards are installed at the end of winter and removed in autumn. The effect of flow diversion and impoundment is essentially an elongated "lake" area from late spring to late autumn. In recent years, the weir boards have become degraded and gradual leaking of water during summer leads to water levels defined by land to the east near Ford Road.

Owing to increased inputs of nutrients from catchment sources, and the still conditions created by impoundment, the Lower Vasse River is eutrophic. Extremely high nutrient concentrations, particularly phosphorus, and ideal physical conditions drive severe seasonal algal blooms for up to seven months from November to May. Algal blooms cause unsightly water discoloration and scums and unpleasant odours. These blooms are often dominated by blue-green algae (cyanobacteria) which are potentially toxic and close the waters to public use.

Despite seasonally poor water quality, the Lower Vasse River retains social and natural values. It provides permanent freshwater habitat and vegetated foreshore areas that support native fauna, including many waterbirds, native fish, oblong turtles, freshwater mussels and western ringtail possums. Many people in the community still enjoy the ecological characteristics amenity of the river.

The isolation of the Lower Vasse River by diversion and impoundment; the conditions of extremely poor water quality experienced; and the high profile location have led to the need for specific management of this area. This is the focus of this WMP.

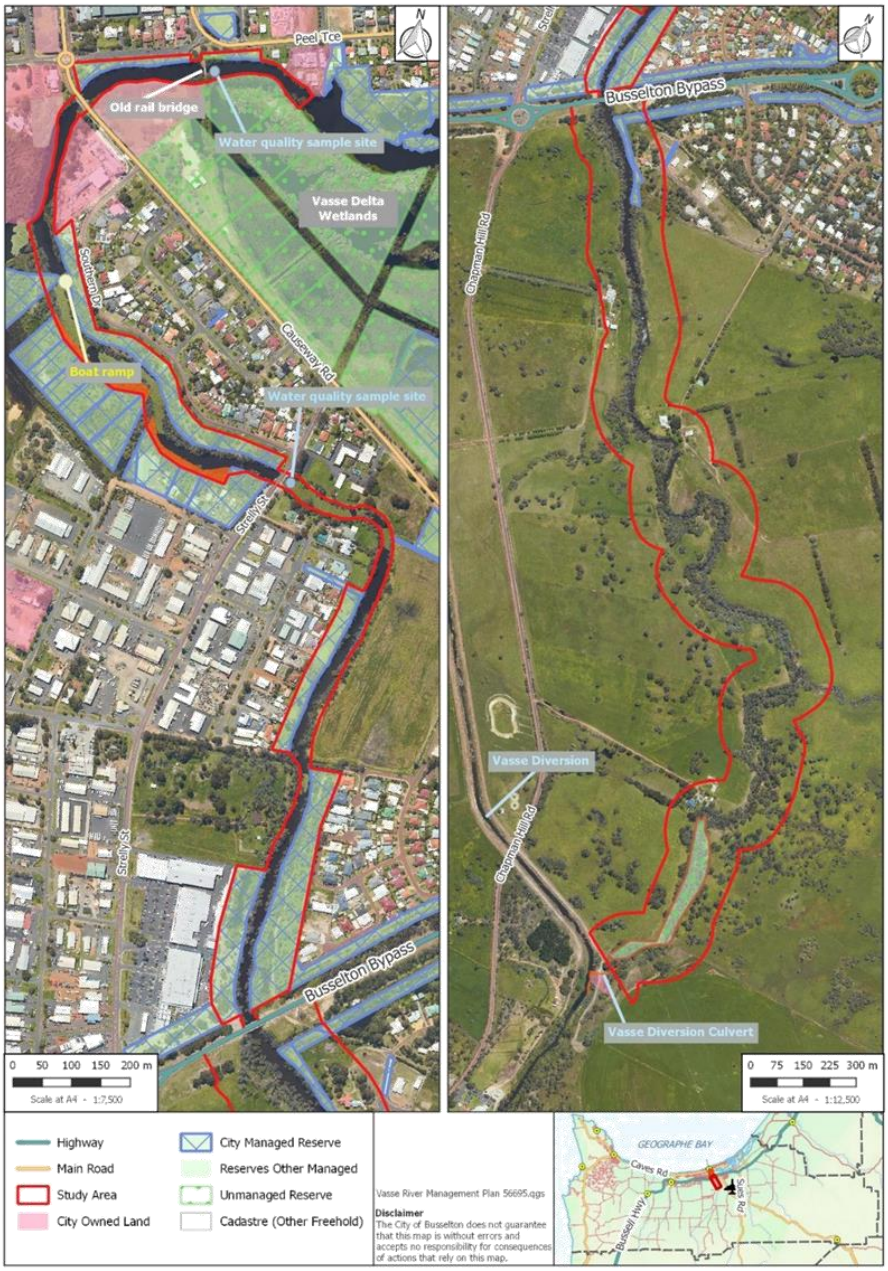

Figure 2. Study area for the Lower Vasse River Waterway Management Plan, showing tenure and landmarks.

1.3 History of management

Poor water quality in the Lower Vasse River has been a focus of management activities for at least two decades. The Lower Vasse River Cleanup Program (LVRCP) commenced in 1999, which implemented a range on-ground works and trials to improve the ecological health of the system (Paice 2005). Key components of the LVRCP were:

- sediment treatment and removal;
- restoring river ecology;
- rural catchment management; and
- urban catchment management.

These approaches had some success and have provided useful information for future work. The revegetation undertaken through this project has doubtless enhanced the ecological values of the river. However water quality remains extremely poor with severe algal blooms recurring each year during the warmer months. A review of the LVRCP recommended priority areas for action as:

- continued partnerships to assess appropriate sediment remediation options;
- maintenance of revegetated areas in terms of weed control;
- continued revegetation with emergent and submerged plants;
- formalise agreed management of water flows through the river to maximise flushing;
- management of the feral goldfish population;
- identifying and addressing point source problems in particular septic tank leachate; and
- ongoing monitoring and evaluation to measure progress towards long term objectives (Paice 2005).

Since the Lower Vasse River Cleanup program, managers have continued to implement nutrient reduction actions in the rural and urban catchments, including river restoration, implementation of best management practices and installation of stormwater treatments. There have also there have been small scale studies to assess potential for improving water quality using other measures such as enzyme treatments, floating islands and establishing aquatic plants.

The independent review of the waterways management (Hart 2014) highlighted the lack of an obvious lead agency. It made the distinction between long-term reduction of nutrients from the overall catchment, and short-term management of the impounded reach Lower Vasse River. It highlighted the need for an operational management plan for this section of the river that would address the dual objectives of achieving good water quality while also preventing flooding in Busselton.

1.4 Process for developing the Waterway Management Plan

The WMP has been developed using a collaborative approach that has allowed for extensive consultation to work towards future management of the Lower Vasse River that aligns with community priorities, is well-understood and accepted, and has significant commitment to implementation by stakeholders. Key stakeholders that contributed to this WMP are:

- City
- Community members
- Aboriginal People
- GeoCatch
- Department of Water and Environmental Regulation
- Department of Biodiversity, Conservation and Attractions
- Water Corporation

The process for developing the WMP is shown in Figure 3. The consultation process has contributed directly to the management issues, vision, management objectives, management strategies and actions for the WMP. Activities undertaken for consultation are outlined in the following sections. The consultation process and the overall WMP have been informed by review of existing information about the Lower Vasse River and new information gained through projects undertaken during the planning process. It is important to note the adaptive nature of this WMP. It has been prepared at a point in time, using the information currently available. Implementation will require an ongoing process of monitoring and evaluation to determine future actions.

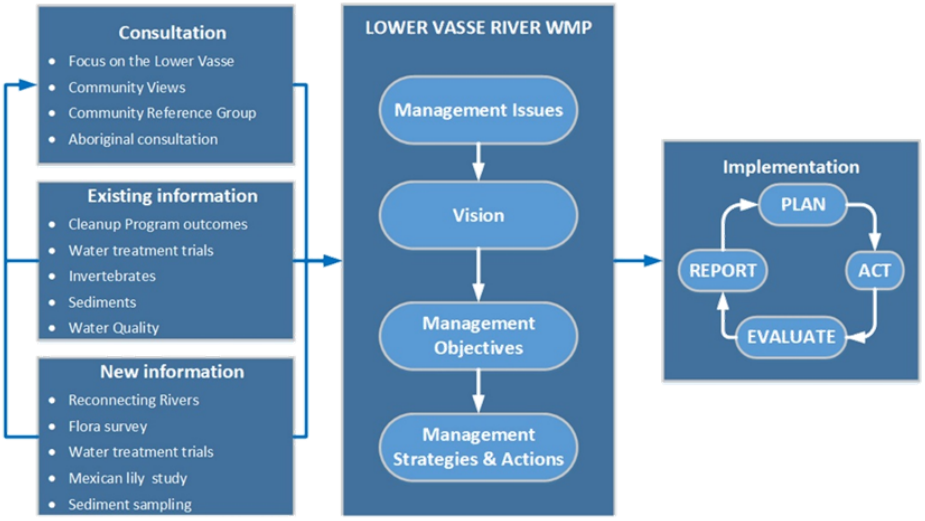

Figure 3. Process for developing the Lower Vasse River Waterway Management Plan

1.4.1 Community consultation

Consultation with stakeholders was an integral part of preparing this WMP. The aims of consultation were:

- To understand community issues and concerns on the Lower Vasse River;
- Gain input, ideas, feedback into future management of the Lower Vasse River;
- To get support from the community on proposed actions; and
- To raise community awareness and understanding of local water quality issues.

Early consultation events were widely advertised to attract a broad representation from the community. The first of these, *Focus on the Lower Vasse* in June 2015, provided current information and sought to identify issues of most importance to the community. The *Community Views* event in March 2016 was also open to whole community and facilitated rating of management issues valued characteristics and desired change (Figure 4; AHA 2016). These results reflected a high level of importance on issues related to the health of the Lower Vasse River and associated amenity (82%). Other issues rated as important were recreation and access, heritage, flood and management. The outcomes of this consultation were used to formally identify key management issues, as outlined in Section 2 of the WMP. Information provided by the community regarding their understanding of the system and suggested management actions were used to develop draft management objectives, and were considered when reviewing management options.

Following initial consultation, the Lower Vasse River Community Reference Group (CRG) was formed to provide ongoing input to WMP. This group was formed by inviting participants of earlier events to nominate for ongoing involvement. It also included representation from the Department of Water and Environmental Regulation and GeoCatch, as key supporting partners in development of the WMP. Facilitated workshops with this group were held to develop the vision, management objectives (AHA 2017a, 2017b) and management strategies and actions (AHA 2018) for the WMP.

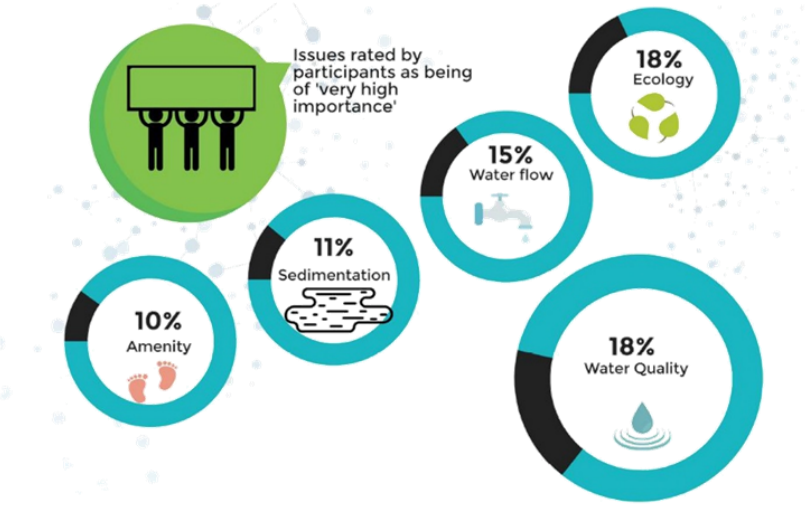

Figure 4. Outcomes of identifying and rating management issues for the Lower Vasse River from the *Community Views* consultation session, March 2016.

1.4.2 Aboriginal consultation

In recognition of Aboriginal (Wadandi) people as the traditional custodians of country, and understanding the significance of waterways to Aboriginal people, additional consultation was undertaken with the South West Boojarah (SWB) and Harris Family native title claim groups to allow their input to the WMP.

The study area is within the South West Boojarah Indigenous Land Use Agreement area which is one of six Agreement areas that form part of the South West Native Title Settlement Area[1].

Presentations were given to the South West Boojarah (SWB) Working Party and subsequent during an Aboriginal heritage survey. An overview of the RGW program and the draft management objectives were presented to the SWB Working Party.

An aboriginal heritage survey was undertaken with representatives of the SWB and the Harris family native title groups in February 2018, encompassing the study areas of the Lower Vasse River and Toby Inlet water management plans and the Vasse Wonnerup Operation Plan. The survey was facilitated by Brad Goode and Associates (BGA) and included briefings and a bus tour of key sites for discussion of scientific investigations, future management actions and the content of the plans (BGA 2018). On-site discussions were held on key potential management actions including sediment removal, water treatment, reshaping and revegetation, Mexican waterlily control.

The representatives highlighted the importance of connectivity of waterways in the landscape from both spiritual and ecological perspectives. They highlighted the importance of managing the headwaters of the river to address the real cause of poor health in the lower reach, relating problems in the Lower Vasse to disruption of connectivity with its catchment. They also acknowledged that it is not practical to return the river's hydrology to its natural state. The group supported specific works to address sediment and water quality problems, including sediment removal and waterlily control. Information from this consultation has been considered in the development of management strategies and actions in this WMP.

[1] Current information on the South West Native Title Settlement: http://www.noongar.org.au

2 Management Issues

Through the consultation process, management issues were grouped into the following eight key focus area for management:

1. Water quality
2. Ecology
3. Water flow
4. Sedimentation
5. Amenity
6. Recreation and Education
7. Heritage
8. Governance

The most important issues for management the Lower Vasse River as rated through community consultation are water quality, ecology, water flow, and sedimentation. These are key river health issues, which are interconnected and fundamental to ongoing management of the river.

Management strategies which provide outcomes for river health will contribute directly to social issues by improving amenity and increasing opportunities for recreation and education. In turn, facilities to provide for these activities will allow for promotion of cultural heritage values. Governance relates to policy and management responsibilities, which will underlie the implementation of strategies to improve river health.

A summary of key management issues and available information for these focus areas is provided in this section.

2.1 Water quality

2.1.1 Nutrients and algal blooms

The Lower Vasse River is a eutrophic waterway, with very high nutrient concentrations resulting in extremely high densities of phytoplankton (microscopic algae), commonly referred to as algal blooms. These algal blooms persist for up to seven months each year, generally between December and May, resulting in discoloured water, unsightly scums and unpleasant odours. The blooms are dominated by blue-green algae (cyanobacteria), which are potentially toxic to animals and humans (Figure 5). Not surprisingly, water quality is the most significant management issue for the Lower Vasse River.

It is interesting to note that "thick algae" was observed in the river in 1940 (Mouritz, Elphick and Anderson).

Nitrogen and phosphorus are the main nutrients contributing to eutrophication. Nutrients have been regularly sampled by DWER at two sites in the Lower Vasse River (Figure 2):

i. Strelly Street Bridge from 1996 – 2010, and since January 2017 (excluding winter since 2000);
ii. Old rail bridge from 1996 – 2010.

Total nitrogen (TN) concentrations have often exceeded ecosystem protection guidelines in the past (Figure 6a). However, sampling in recent years has lower TN concentrations, particularly at the Strelly Street site. Monthly data for the old rail bridge site shows high TN in winter and a gradual decrease

during spring, followed by an increase to very high levels in summer (Figure 6b). Peak TN in summer corresponds to peak algal growth (Figure 6e), and is likely related to the ability of blue-green algae to fix nitrogen from the atmosphere. Very little nitrogen is present in dissolved available forms, which limits the amount available for growth or other types of algae.

Total phosphorus (TP) concentrations in the lower Vasse River are extremely high with annual and monthly means consistently exceeding ecosystem protection guidelines, often by an order of magnitude (Figure 6c, d). Phosphorus concentrations show a seasonal increase from spring to summer and then remain high (Figure 6d). Unlike nitrogen, the phosphorus concentrations are higher at the Strelly St Bridge site upstream, where algal blooms have been less severe in recent years (Figure 6e). This is unusual, as phosphorus is known to promote algal growth. Dissolved phosphorus is consistently high at the Strelly Street site, accounting for an average 48% of TP. At the old rail bridge site, dissolved phosphorus accounts for an average 17% of TP, and decreases over the duration of the season. Dissolved oxygen concentrations are much lower at the Strelly Street site than downstream and this may be linked to higher phosphorus concentrations, as phosphorus is released from sediments under low oxygen conditions.

Chlorophyll a is an indicator of phytoplankton growth, and very high concentrations throughout the river until 2010 reflect seasonal algal blooms. Chlorophyll a has been much lower at the Strelly St Bridge site since sampling recommenced in the 2016-17 season (Figure 6e). It has remained high at the old rail bridge in recent years, showing a seasonal increase in correspondence to increasing algal growth in the summer (Figure 6f). This is also reflected in monitoring of phytoplankton cell densities and species (Figure 8), which shows continuing dominance by blue-green algal blooms at the old rail bridge; but a substantial reduction at Strelly Street. There has been a shift at the Strelly St site to harmless species of green algae, with occasional 'bloom' densities. Lower phytoplankton growth at the Strelly Street site is no doubt due to the recent presence of Mexican waterlily at this site. The waterlily prevents light entering the water column, preventing algal growth. However, as discussed in Section 2.2.3, Mexican waterlily appears to reduce algal growth more broadly.

2.1.2 Nutrient sources

Nutrients in the Lower Vasse River come from surface runoff and groundwater infiltration; and are also released into the water column from the sediment (0). Nutrient sources include residential, commercial, industrial and rural sources in its local catchment area (downstream of the Vasse Diversion), as well as some flows from the Vasse Diversion. In addition to ongoing inputs to the river, nutrients accumulate in the sediments from the ongoing cycle of algal growth and decay, providing an internal source of nutrients (2.4).

Water quality analysis and modelling for the Water Quality Improvement Plan (WQIP) estimated that septic systems in the Busselton light industrial area (LIA) contribute 0.45 tonnes (9.4%) of phosphorus 1.3 tonnes of nitrogen 3.7% to the river annually (DoW 2010). This modelling also predicted that urban expansions in the catchment could result in a 41% increase in phosphorus load and a 23% increase in nitrogen load. Importantly, the WQIP also identified one feedlot as being the largest contributor of phosphorus in the Lower Vasse River catchment (since converted to irrigated horticulture, and likely to remain a significant phosphorus source). Dairy sheds also contribute a significant proportion of nutrients from broader agricultural areas.

Nutrient concentrations in the Vasse Diversion vary widely from acceptable to extremely high, with mean annual concentrations since 2008 of 1.6-2.4 mg/L for TN and 0.03-0.23 mg/L for TP. Nutrient inputs to the Vasse River depend on the operation of the culvert valve connection to allow water to flow through the 900mm pipe at the upper end of the river (Section 2.3). Opening of the valve connection is not formally managed and flows are not formally recorded. There may be potential to optimise management of the valve connection to reduce flows when nutrient levels are high. Community perception is that water flow from the Vasse Diversion to the Lower Vasse River should be maximised to improve water quality by flushing the river.

2.1.3 Downstream impacts

In addition to problems associated with nutrient enrichment within the river itself, high loads of nutrients flowing through the river influence the wetlands and the Vasse Estuary downstream. The WQIP reports that the Lower Vasse River contributes very high nutrient loads to downstream waters relative to its catchment size (DoW 2010); and recommends long-term load reductions of 67% for phosphorus and 70% for nitrogen to meet acceptable loadings for the Vasse-Wonnerup Wetlands. Management actions for the Lower Vasse River need to consider downstream impacts. For example, increasing flows from the Vasse Diversion to the Lower Vasse River would increase nutrient loads from this source to the Vasse Estuary (Section 4.8).

Figure 5. Blue green algal bloom in the Lower Vasse River.

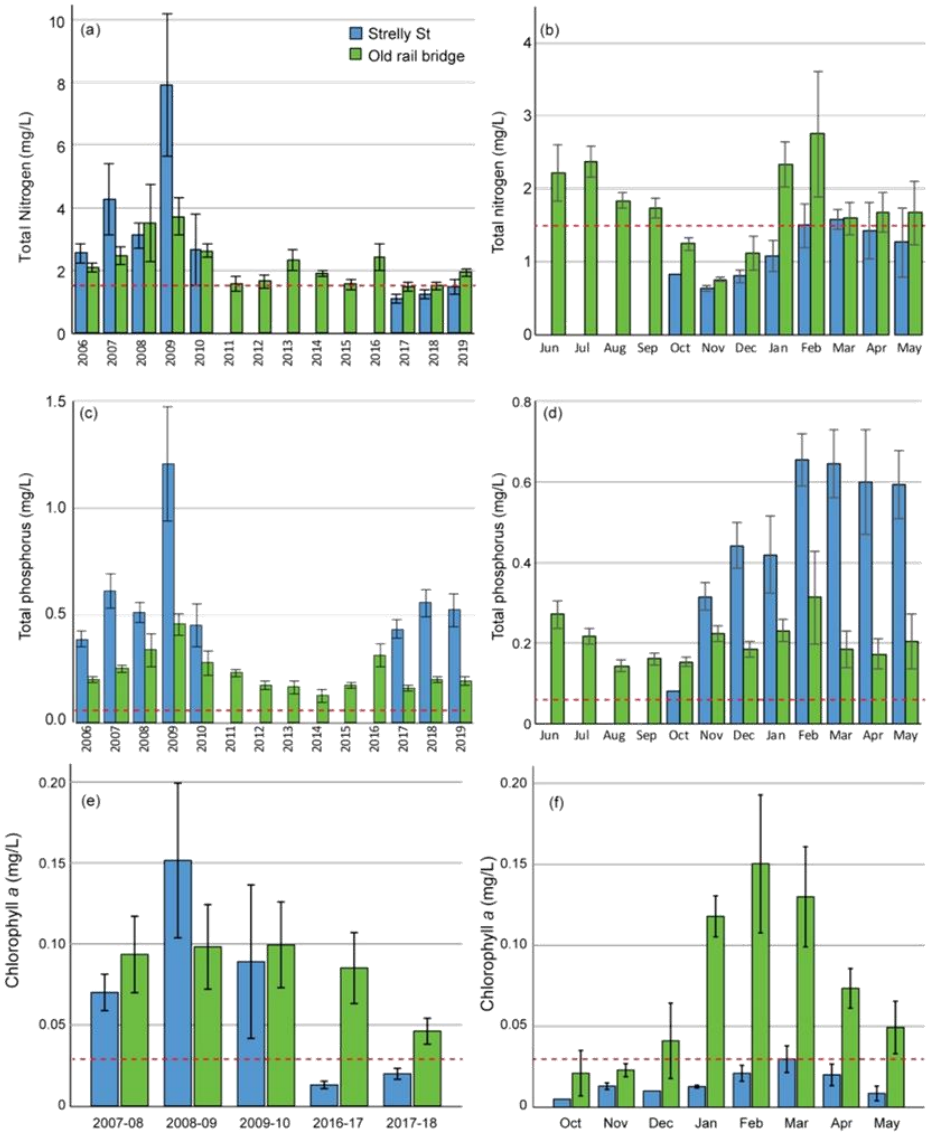

Figure 6. Mean annual and monthly concentrations of total nitrogen (a, b) and total phosphorus (c, d); and mean chlorophyll a across annual spring-summer-autumn sampling seasons (e) and for each month (f). Red dashed lines are guidelines for protection of wetland ecosystems (ANZECC and ARMCANZ 2000). Monthly nutrient data from 2011-2018; monthly chlorophyll *a* data since 2017 (DWER 2018a). Error bars are +/- standard error.

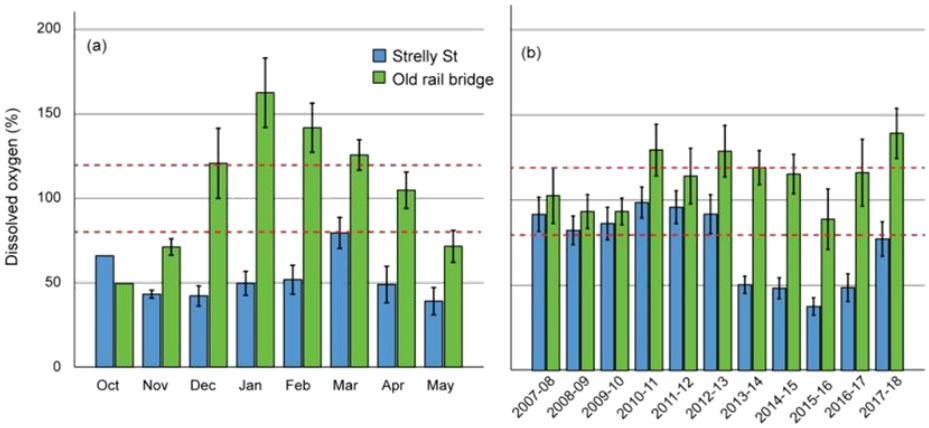

Figure 7. Dissolved oxygen concentrations in the Lower Vasse River: average monthly means for 2016-2018 centred around summer (a); and annual means since 2007-08 (spring-autumn sampling) (DWER 2018a).

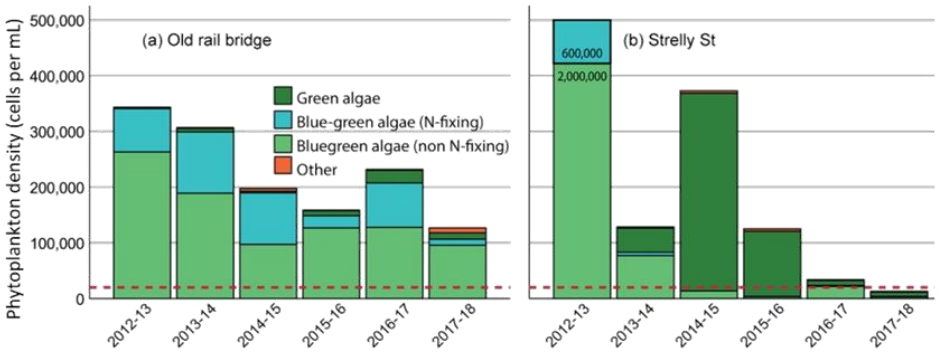

Figure 8. Mean cell densities for main phytoplankton species groups at sampling sites in the Lower Vasse River during spring-summer-autumn seasons since 2012 (DWER 2018b). Red dashed line is the guideline value of 20,000 cells per millilitre for recreational use.

2.2 Ecology

The Lower Vasse River has undergone substantial physical changes through widening and de-snagging, and clearing of surrounding vegetation. This includes a "clean out" by the Public Works Department around 1939 using a dragline. It has also been impacted by altered hydrology and nutrient enrichment. These changes have dramatically affected the river's ecology. Aboriginal people have stories of fishing and hunting along the Vasse River when water quality was better. However it now has little in-stream habitat and the dominance of phytoplankton during the warmer months supports limited diversity.

Although degraded, it still provides habitat for native freshwater fish, frogs, turtles and invertebrates, and open water areas for waterbirds. The riparian vegetation contributes to aquatic habitats and also

supports a range of terrestrial fauna and birds. The permanent fresh waters of the Lower Vasse River provide a unique habitat in a landscape of seasonal wetlands and estuaries.

Ecology was rated as the most important management issue by 18% of *Community Views* participants (AHA 2016). The river environment contributes to local amenity and the birdlife is particularly enjoyed. The study area has been identified as a regional ecological linkage (Molloy et al. 2009, Ecoedge 2017). A summary of the main ecological components of the Lower Vasse River study area and implications for management is provided below.

2.2.1 Vegetation

Native fringing (riparian) vegetation of the Lower Vasse River has been largely cleared, leaving a narrow strip of remnant trees with limited understorey and extensive weed invasion. There are opportunities to enhance vegetation in the study area through weed control and revegetation.

Vegetation along the river provides important habitat for terrestrial fauna, with overhanging trees offering many roosting and nesting sites for waterbirds. In addition to providing habitat benefits, fringing vegetation is a vital component of river health. The important functions include:

- supporting terrestrial and aquatic food webs;
- habitat for terrestrial and aquatic fauna;
- foreshore stabilisation;
- maintaining cooler temperatures
- interception of nutrients and sediments in runoff; and
- nutrient uptake and processing.

The extent and diversity has been increased downstream of the Busselton bypass by revegetation work done for the Lower Vasse River Cleanup program and in new foreshore reserves adjacent to subdivided land. A vegetation survey in the study area in 2017 found only 5.6% of vegetation in good condition, occurring mainly within these revegetated areas (Ecoedge 2017).

The current vegetation includes only 28 native species, including some species in revegetated areas that would not have occurred there naturally. The Ecoedge (2017) survey found no occurrences of threatened or priority flora, although there are nearby occurrences of the Coastal Saltmarsh threatened ecological community (TEC); and the *Eucalyptus rudis*, Marri and Peppermint forest ecological community (Priority 1).

At least 20 species of weeds are present, including 10 of environmental concern, which are mapped in the Ecoedge (2017) survey report. The most widespread problem weeds are Arum Lily, Brazilian pepper tree and Kikuyu (Ecoedge 2017). Kikuyu and other grassy weeds form an extensive component of the understory in much of the study area. Less widespread but potentially invasive weeds include Blue periwinkle, Weeping willow and Watsonia. Within the waterway, Mexican waterlily has infested large areas.

2.2.2 Fire Risk

Management of vegetation needs to address current and future risk of fire, particularly in areas close to buildings and infrastructure. A Bushfire Attack Level assessment can be used to determine suitable setbacks (Calibre 2018). Adequate setbacks to sensitive infrastructures, strategic gaps between vegetated areas limiting width of vegetation can be used to reduce fire risk where required. Selection

of species for revegetation that have lower flammability and maintaining moisture content through irrigation can also mitigate risk (Calibre 2018).

2.2.3 Mexican waterlily

Mexican waterlily (*Nymphaea Mexicana*) covers large areas of the Lower Vasse River (Figure 9a,b). Although present in small patches in the river for several years, it underwent rapid expansion during the 2013-2014 spring-summer growing season and has continued to spread gradually since then. In 2017 it covered 23% and 1.15 hectares of water between the Busselton Bypass and the Butter Factory weir.

This is a serious concern for the community and management authorities owing to impacts on visual amenity, loss of open water habitat and possible flow obstruction. Overhanging fringing vegetation supports many roosting and nesting sites for birds. Growth of lilies beneath these sites prevents diving from these platforms and creates a risk for fledglings that may get trapped in the lilies beneath nests. Loss of open waters reduces space for birds to swim and dive and reduces available habitat for fish and turtles.

A study on the impacts of Mexican waterlily in the Lower Vasse River in 2017 investigated the effects of these plants on water quality and ecology (Paice 2018). In addition to the obvious problem of loss of open waters, the lilies result in very low oxygen levels in the water (Figure 10a), presenting a risk for aquatic fauna. Despite this, the structural habitat provided by the lilies supports greater abundance and diversity of aquatic invertebrates than other parts of the river. However this invertebrate population does include large numbers of non-biting midge larvae, which can contribute to nuisance insect problems.

The extensive root mass of the lilies and ongoing growth and decay contributes to a build-up of organic material, creating shallower conditions. This has allowed additional colonisation of semi aquatic plants. Currently, this has been seen the native (though prolific) Slender knotweed, *Persicaria decipiens*), but there is a risk of colonisation by wetland weeds. The reduced depth is now evident upstream of Strelly Street where waterlilies have died back from herbicide use.

Mexican waterlily has also had an effect on nutrient levels and growth of phytoplankton. Since the period of expansion in 2013-14, algal blooms have been greatly reduced in waters upstream of the point of infestation (near the boat ramp area along Southern Drive) (Figure 9c, d, Figure 10c). This is despite very high phosphorus concentrations in these areas; much higher than downstream Figure 10b). The reasons for reduced algal blooms between patches of waterlily are not fully understood. It may be a combination of greater low residence time in sunlit areas owing to lilies and riparian shading; nitrogen limitation; or chemical inhibition.

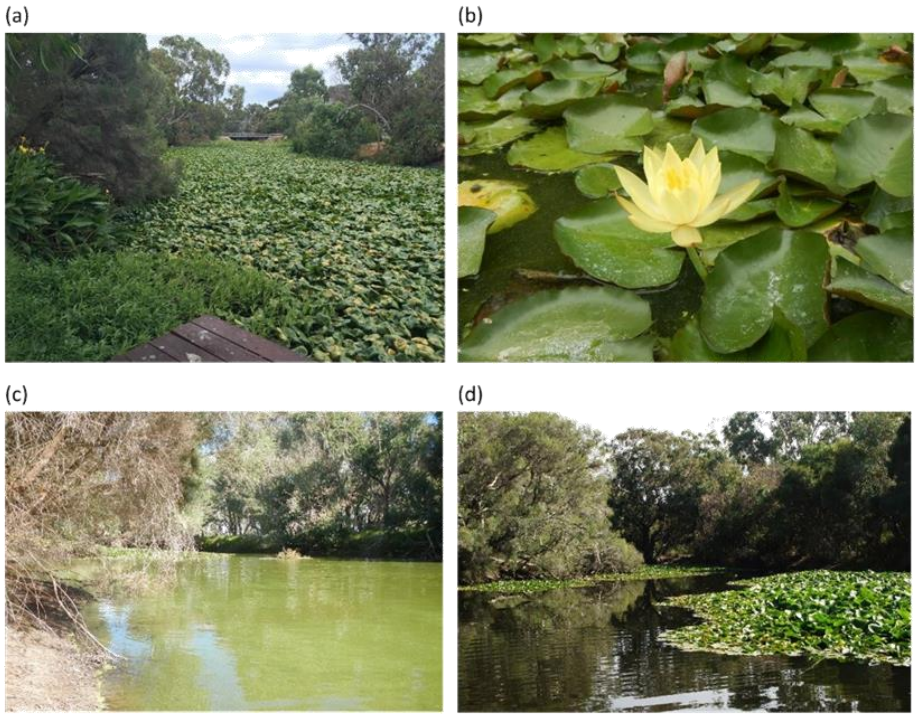

Figure 9. Mexican waterlily in the Lower Vasse River: (a) extensive growth upstream of Strelly Street in March 2017; (b) flower; (c) downstream of infestation in April 2014 showing obvious algal bloom; (d) upstream of infestation in April 2014 (same day) with no algal bloom.

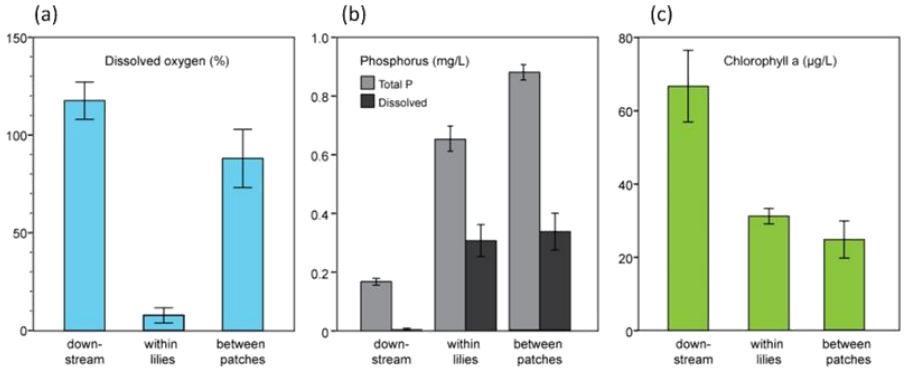

Figure 10. Comparison of water quality in relation to Mexican waterlily in the Lower Vasse River: downstream of the waterlily infestation, within dense waterlily growth, and in areas of open water between patches of waterlily (200-300m reaches) (Paice 2018).

2.2.4 Birds

The birdlife in and around the Lower Vasse River was rated by the community as the most liked characteristic (AHA 2016). Protecting and enhancing habitat for birds and providing opportunities for enjoyment of birdlife should be part of future management.

Table 1 provides a list of bird records available for the Lower Vasse River. There are probably more than this, however limited data is available. There is little formal published information about the birdlife of the Lower Vasse River, and there is scope to improve understanding and to share knowledge. Fostering existing community efforts in birdwatching to capture data would be a good step towards achieving this.

Remnant fringing rushes and overhanging trees provide important nesting and roosting sites. Secluded sections of the river and the southern bank adjacent to Southern Drive support some very dense nesting areas for cormorants, darters, Night heron and Yellow-billed spoonbills. In addition to the areas of remnant native rushes, grassy weeds also provide habitat for birds on the banks of the river, and this should be considered when undertaking weed control.

Threats to birds of the Lower Vasse River include predation by dogs, cats (domestic and feral) and foxes; degradation of vegetation through declining tree health, weed invasion and clearing; and loss of open water habitat by expansion of Mexican waterlily.

Table 1. Bird species recorded in the Lower Vasse River (Birdlife Australia 2018, Birdlife Western Australia 2017; Paice et al. 2016).

Common Name	**Scientific Name**
Australasian grebe	*Tachybaptus novaehollandiae*
Australasian shoveler	*Anas rhynchotis*
Australian pelican	*Pelecanus conspicillatus*
Australian reed-warbler	*Acrocephalus australis*
Australian spotted crake	*Porzana fluminea*
Australian white ibis	*Threskiornis molucca*
Australian wood duck	*Chenonetta jubata*
Black swan	*Cygnus atratus*
Black-fronted dotterel	*Elseyornis melanops*
Black-winged stilt	*Himantopus himantopus*
Blue-billed duck	*Oxyura australis*
Buff-banded rail	*Gallirallus philippensis*
Darter	*Anhinga melanogaster*
Dusky moorhen	*Gallinula tenebrosa*
Eastern great egret	*Ardea alba modesta*
Eurasian coot	*Fulica atra*
Great egret	*Egretta garzetta*
Grey teal	*Anas gracilis*
Hoary-headed grebe	*Poliocephalus poliocephalus*
Little black cormorant	*Phalacrocorax sulcirostris*
Little grassbird	*Megalurus gramineus*
Little pied cormorant	*Phalacrocorax melanoleucos*
Musk duck	*Biziura lobata*
Nankeen night heron	*Nycticorax caledonicus*
Pacific black duck	*Anas superciliosa*
Purple swamphen	*Porphyrio porphyrio*
Spotless crake	*Porzana tabuensis*
White-faced heron	*Egretta novaehollandiae*
Yellow-billed spoonbill	*Platalea flavipes*

2.2.5 Aquatic fauna

The key management issue for aquatic fauna is degraded habitat, in terms of limited structural habitat and poor water quality. Although a range of aquatic fauna occur in the Lower Vasse River, the degraded conditions no doubt limit the populations it can support. While management should therefore focus on enhancing habitat and reducing threats, such actions may have short term impacts on existing individuals. Nevertheless the Lower Vasse River has been found to have high ecological value worthy of protection, including a fish and crayfish community dominated by native species and with evidence of successful recruitment (DWER 2019).

Fish

Eight native fish species have been recorded in the Lower Vasse River during a fish survey in 2003-2004 and during subsequent goldfish control work: four freshwater species and four estuarine species (Table 2). These species have been heavily impacted by alteration and loss of habitat in the south west region, requiring structural habitat and refuge in permanent freshwaters. These species are generally only found in low numbers in the Lower Vasse River; although higher numbers of the Western pygmy perch and the occurrence of the Mud minnow (listed as vulnerable under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017) at a site just downstream of the Vasse Diversion outflow suggest better habitat there (Morgan and Beatty 2004). The estuarine Western hardyhead was most abundant downstream of the Butter Factory weir and the survey reported that this structure may impede migration of native fish (Beatty *et al*. 2011).

Two introduced fish species are widespread in the Lower Vasse River: mosquitofish and goldfish. Mosquitofish are small and commonly seen in very large numbers in the river. Significant numbers of large goldfish occur in the Lower Vasse River. They have been noted as being common in the river near town in 1956; and trout were released in the river in 1957 (Mouritz, Elphick and Anderson), but have not been reported since then.

The presence of goldfish is an important issue owing to their contribution to poor water quality and algal blooms. Their benthic foraging disturbs nutrient-rich sediments and there is evidence that growth of blue-green algae is stimulated following ingestion and passage through goldfish (Kolmakov and Gladyshev 2003). A program of annual removal from 2003 to 2013 removed 842 goldfish, some exceeding 40cm in length, from the Vasse River (Beatty et al 2014).

Other aquatic fauna

Southwestern snake-neck turtles (*Chelodina oblonga*, Oblong turtles, Western long-necked turtle) are regularly observed in the Lower Vasse River, although they have not been specifically studied. There is no published information about frogs in the study area. Decapods recorded in the study area are the endemic Gilgie (*Cherax quinquecarinatus*) and the introduced Yabbie (*Cherax destructor*) (Beatty *et al*. 2011).

Carter's freshwater mussel (*Westralunio carterii*) is common in the Lower Vasse River, showing a preference for structured benthic habitats such as bridges (Beatty et al. 2017). It is listed as vulnerable fauna (Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017; IUCN Red List).

Aquatic invertebrates are commonly used as indicators of ecological health. The open waters of the river contain little structural habitat and supports very low diversity of invertebrates, dominated by

zooplankton (mostly copepods) and highly mobile predators (of zooplankton) such as backswimmers (Notonectidae) and water boatmen (Corixidae) (Paice et al. 2016). The presence of aquatic plants and waterlilies greatly increases diversity and abundance of aquatic invertebrates in the river, owing to increased structural habitat and alternative food sources. In the case of waterlilies, this included mainly robust species tolerant of poor water quality and low oxygen conditions (Paice et al. 2016). However, growth of submerged plants (as transplants) has been shown to support significantly higher abundance and diversity across a range of functional groups (Paice 2018).

2.2.6 Other fauna

A range of other fauna are known to occur in remnant vegetation in the study area, but have not been formally surveyed. Importantly this includes the Western ringtail possum (Ngwayir, *Pseudocheirus occidentalis*), which is listed as critically endangered fauna (Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017). Grey kangaroos are common in some parts of the study area and adjacent land and the river may provide a corridor for their movement within and increasingly developed landscape. Water rats (Rakali, *Hydromys chrysogaster*) have been anecdotally observed but are not common.

Table 2. Fish in the Lower Vasse River (Morgan and Beatty 2004, Beatty et al. 2011)

Type / Common name	Species	Notes
Native freshwater fish		
Western pygmy perch	*Edelia vittata*	Widely distributed, low numbers
Western minnow	*Galaxias occidentalis*	Few sites, low numbers
Nightfish	*Bostockia porosa*	Few sites, low numbers
Mud minnow	*Galaxiella munda*	Headwater site only, vulnerable
Native estuarine species		
Western hardyhead	*Leptatherina wallacei*	Downstream sites
Swan River goby	*Pseudogobius olorum*	Widely distributed
Sea Mullet		Downstream, low numbers
Black bream	*Acanthopagrus butcheri*	One fish
Introduced fish		
Goldfish	*Carassius auratus*	Widely distributed,
Mosquitofish	*Gambusia holbrooki*	Widely distributed, large numbers

2.3 Water flow

There have been substantial changes to the hydrology of the Lower Vasse River and its catchment. The coastal plain area of the catchment has been modified by a drainage network constructed during the 1920s to facilitate settlement, transport infrastructure and agricultural development (English 1994). This involved widening, straightening and de-snagging of water courses, and construction of artificial channels. Approximately 90% of catchment flows are diverted via the Vasse Diversion Drain, creating a distinct separation of the section known as the Lower Vasse River. Water flow to the Lower Vasse River from the Vasse Diversion is controlled by a manually operated valve on a 900mm pipe.

At the downstream end of the study area the river is impounded by a weir, established around the 1920s to maintain higher summer water levels through the town section for amenity and recreation

purposes. Removable weir boards are usually installed at the end of winter and removed in autumn. In recent years, the weir boards have become degraded and gradual leaking of water during summer leads to water levels defined by land to the east near Ford Road.

The Lower Vasse River flows via a wetland area known as the Vasse River Delta into the Vasse Estuary. A surge barrier on the Vasse Estuary exit channel, first constructed in 1908, allows outflow of water but prevents inflow of tidal and storm surge waters. This provides flood protection but has reduced tidal exchange throughout the estuary and the lower reaches of the river.

The modified water flow regime of the Lower Vasse River contributes to poor water quality. The effect of flow diversion and impoundment is essentially an elongated "lake" area from late spring to late autumn. Reduced flow velocity contributes to accumulation of nutrients and organic material from the catchment, and the still conditions during summer promote algal blooms. Recurring algal blooms contribute to the build-up of nutrients in sediments, creating an internal source of nutrients.

There is a perception in the community that increasing flows from the Vasse Diversion and removal of the Butter Factory weir boards will create a flushing effect that will improve water quality and mobilise the accumulated sediments. Management of these structures has been restricted by limited understanding of the outcomes and constraints of this approach; and a lack of defined management responsibilities for operation.

(a) (b)

Figure 11. Flow management structures for the Lower Vasse River: (a) the valve controlling flow from the Vasse Diversion to the Lower Vasse River via a 900mm pipe; (b) the weir and removable boards at the Butter Factory.

2.4 Sediments

Sediments

The Lower Vasse River has, over several decades, accumulated a layer of nutrient rich organic sediments, generally about 0.5m thick but up to 1m in some parts (Apex 2012). Sediments accumulate from inputs of organic material from the catchment and from ongoing growth and decay of phytoplankton cells within algal blooms. Low oxygen levels and resuspension of sediments when disturbed releases nutrients to the water column over summer, contributing to algal blooms. Sediments are therefore are a key consideration in addressing water quality problems in the Lower Vasse.

There is a perception by the community that the soft organic sediments in the Lower Vasse River contribute to poor water quality, and general support for sediment removal. However there are many constraints to this management option relating to the pollution content of sediments and potential for acidification; and the high costs associated with removal and disposal. Sediment removal is discussed further in Section 4.11.

The presence of soft organic sediments impacts ecology in other ways. They provide a poor substratum for growth of beneficial aquatic plants, and poor habitat for benthic invertebrates other than worms and midge larvae. This limits biodiversity within the river system and contributes to the dominance of phytoplankton in primary production. Sediment accumulation has reduced the depth of the river over time, filling in deeper habitats and contributing to warm conditions that favour algal growth.

The bathymetry of the river (Figure 12) shows the gradual increase in depth moving downstream. There are two areas that are notably deeper: downstream of the Causeway Road bridge and downstream of the Butter factory weir. This suggests scouring of sediments downstream of these constrictions, which may indicate some potential for controlling sediment using flow regimes.

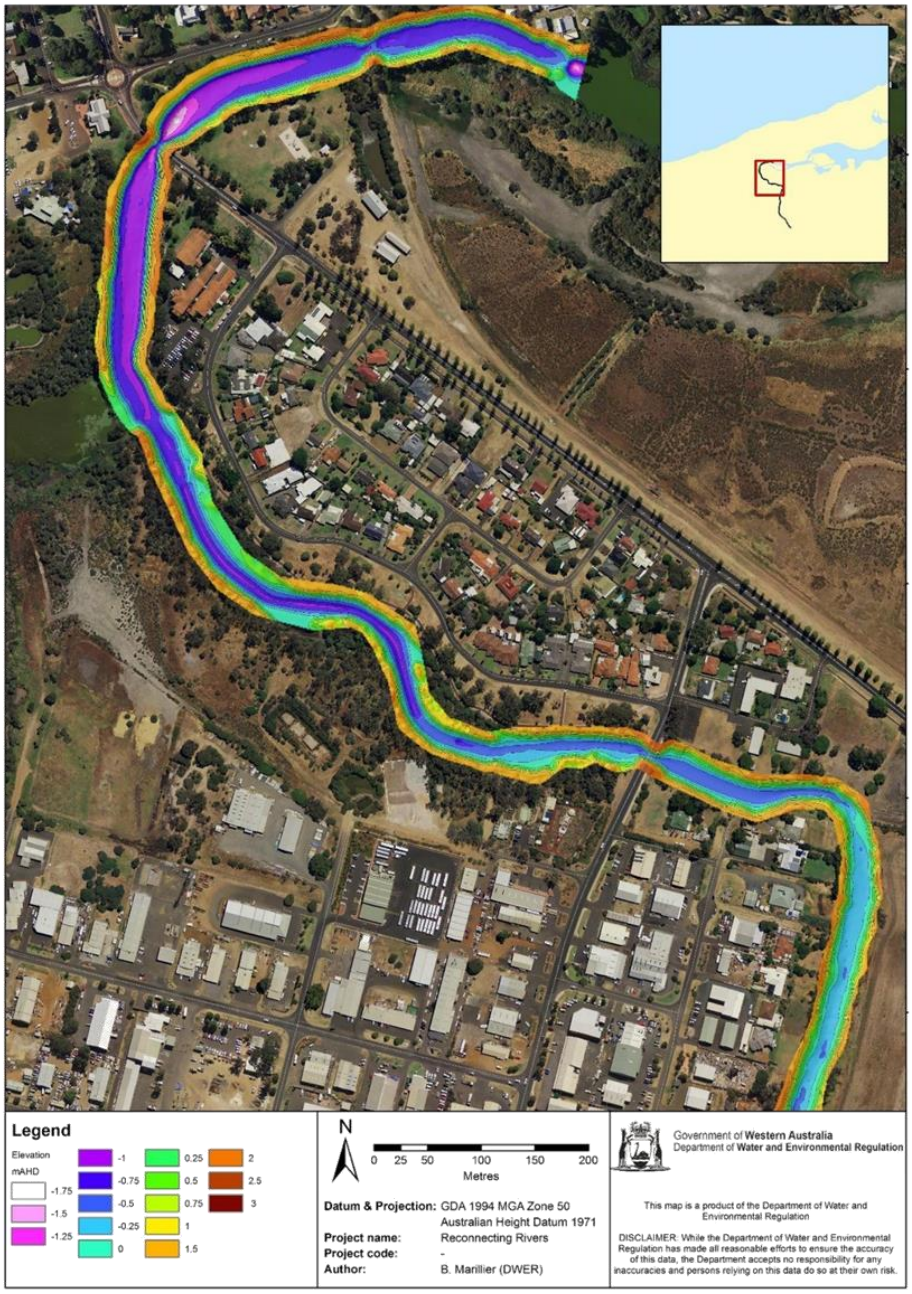

Figure 12. Lower Vasse River bathymetry from Butter Factory weir boards to Isaac Street reserve.

2.5 Amenity

Amenity describes the attractiveness of a place, and for the Lower Vasse River this is directly related to water quality. Algal blooms cause obvious green discoloration of the water, unsightly scums and unpleasant odours. There is concern that the poor amenity of the river during peak the tourist season creates a poor impression at the entrance to Busselton.

Despite poor water quality, natural values of the river environment, particularly the bird life, are still enjoyed by many in the community. Amenity is closely linked to the adjacent reserve and opportunities for recreation and access, which can enhance enjoyment of the Lower Vasse River.

2.6 Recreation and education

Poor water quality has greatly reduced the opportunities for recreational activities in the river during the warmer months. Persistent and severe algal blooms, often dominated by harmful blue-green species (cyanobacteria), cause closure of the water to public use. Access and recreation was rated highest as the focus area requiring change (AHA 2016.

Although algal blooms are seasonal, permanent warning signs are in place to advise against contact with the water. There is potential for recreational use of the water when there are no algal blooms, however signage does not indicate any safe period for contact.

In the past, the waters were used more extensively for recreation. In the 1940s the paddle wheel steamer *Jumna* carried passengers between the town and the Cattle Chosen homestead (Mouritz, Elphick and Anderson). There are anecdotes of canoeing, swimming and fishing and in the past. Whiting, Mulloway, Bream and Mullet have been anecdotally caught in the lower reach. Mullet and Black bream were caught during recent fish sampling but people no longer fish for them.

The Busselton Festival started in 1964, and crowning of the Festival Queen on the river bank opposite the City Administration building. The Festival Queen travelled on a barge from the boat ramp upstream and the community gathered on the banks to watch. At some point this ceremony ceased, though it is not clear when, probably due to poor water quality during the summer festival. In the 1970s there were paddle-boats on the river in town.

Regardless of water quality and restrictions on recreation within the river, a number of trails and public open space areas adjoin the Lower Vasse, which are still regularly used by the community. Rotary Park provides good public infrastructure near the river. Algal blooms and associated odours associated with a do impact use of these areas at times. There is significant potential for improved recreational, amenity and cultural connection with the river through enhancing and protecting natural values and improving facilities. Clearly though, addressing water quality is essential for improving recreational opportunities.

2.7 Culture and heritage

The river is highly valued by the local community and has historically been an iconic feature of the town and focal point for recreational and social events. There is a strong Aboriginal cultural connection to the river and many historical features. Heritage was rated as an issue of very high importance by the community.

2.7.1 Aboriginal heritage

The Lower Vasse River holds significant value for the local Wadandi people. There is a strong spiritual connection with all waterways in the area associated with the Waugul, and they are seen as a fundamental part of all life (Huxtable 2018). In pre European times, Aboriginal People used the Vasse River and its natural resources extensively.

With European settlement and alterations to the landscape, traditional uses of the river have been substantially impacted.

> *Before all the drains were put in the Vasse River was a system of walk trails. The old people would follow the river down to here, singing songs of the elders. We utilised the bush for medicine and food. It's a supermarket, everything we need is right here, the country provides everything we need.*
>
> (I. Webb, as cited in Huxtable 2018)

During consultation, Aboriginal representatives highlighted the importance of connectivity of waterways in the landscape from both spiritual and ecological perspectives. They highlighted the importance of managing the headwaters of the river to address the real cause of poor health in the lower reach, relating problems in the Lower Vasse to disruption of connectivity with its catchment. Representatives also acknowledged the need for intervention to improve the health of the river.

In a formal management sense, the study area is within the South West Boojarah Indigenous Land Use Agreement area within the South West Native Title Settlement Area[2]. An area encompassing the New River wetland area, including part of the study area, is a registered site under the *Aboriginal Heritage Act 1972*. In addition, there may be sites of cultural significance which are not reported or registered for cultural and political reasons. This will necessitate further consultation as specific management actions are developed.

2.7.2 European history

The presence of the Vasse River influenced the decision for settlement, and the development of Busselton and many aspects of social life have long been centred around it (Mouritz, Elphick and Anderson). Prior to settlement the Vasse River was one waterway from its headwaters to Wonnerup, but has been dramatically altered. History shows a connection to the river for many people. Some important historical features and activities associated with the Lower Vasse River are listed below (from Mouritz, Elphick and Anderson).

- Early settlers moved north from the Blackwood River and via the Vasse River towards Busselton.
- The old rail bridge was constructed in 1890, with rail connections to Bunbury, Nannup and Karridale, servicing the timber industry.

[2] Current information on the South West Native Title Settlement: http://www.noongar.org.au

- During the 1830s, the river was used to move goods from the jetty site, via what is now Queen Street, to Cattle Chosen to build the homestead. The small paddle replica paddle steamer *Jumna* transported people from St Mary's Church to Cattle Chosen; this included voyages for many prominent visitors to Busselton.
- The Busselton Festival commenced in 1964, with the crowning ceremony on the banks of the Vasse River a special event.
- The Butter Factory was transferred from Strelly Street to its current site in the banks of the river in 1918, and ceased production in 1975.
- The footbridge near Peel Terrace was built by the local council in 1972.

2.8 Governance

There are two key issues for the Lower Vasse River with regards to governance:

- defining roles and responsibilities for future management; and
- minimising impacts from planning for future developments and land use change.

Management of diffuse and point sources of nutrients from agricultural and urban catchments of the Lower Vasse River is a shared responsibility across GeoCatch, DWER, DPIRD, the City and industry groups. The independent review of water asset management (Hart 2014) recognised this joint responsibility. The Water Quality Improvement Plan (WQIP) provides load reduction targets, management recommendations and identifies key organisations responsible for implementation.

The independent review identified a clear need for a designated manager of the Lower Vasse River 'lake' section. There has been a lack of leadership and funding since the Lower Vasse River Cleanup Program, and thus little progress with management since this program was completed. This issue was also evident during community consultation (AHA 2016). One of guiding principles of the Vasse Geographe Strategy is the appointment of designated lead managers for key water assets. The independent Review (Hart 2014) recommended the City becomes the lead management agency, with continuing assistance from DWER.

The Lower Vase River catchment area will undergo considerable expansion of urban and industrial areas in the future, as identified in the current Draft Local Planning Strategy (CoB 2016). This could result in significant increases in nutrient loads to the Lower Vasse River, and downstream environments (Section 2.1). The City will have an important role in minimising nutrient exports from future developments and land use change; and effectively managing foreshore reserve areas with regard to the vision for the Lower Vasse River. Development is also expected to result in considerable new areas of foreshore reserve being managed by the City (i.e. areas identified as Parks and Recreation in Figure 13).

Figure 13. Draft Local Planning Strategy (2016) land use within the Lower Vasse River study area.

3 Management Objectives

This section presents sixteen management objectives across the eight the focus areas. These were developing in partnership with community members and provide good guidance on the expectations of future management of the Lower Vasse River.

3.1 Water quality

1. Reduce nutrients flowing into the Lower Vasse River from all existing sources to improve water quality and reduce the frequency and severity of toxic algal blooms.
2. Minimise any additional nutrients flowing into the Lower Vasse River from new developments and agricultural intensification.
3. Utilise science and innovative technologies to improve water quality in the Lower Vasse River.

3.2 Ecology

4. Protect and enhance native aquatic and terrestrial habitats in the Lower Vasse River and the foreshore reserve.
5. Reduce the impact of threatening processes on the natural values of the Lower Vasse River and the foreshore reserve.
6. Balance mitigation of fire risks with the protection of natural values of the Lower Vasse River foreshore reserve.

3.3 Water flow

7. Optimise water flow in the Lower Vasse River to balance improvement of water quality, protection of natural values and public amenity, while maintaining flood protection.

3.4 Sediments

8. Strategically manage accumulated sediments to protect the natural and social values of the Lower Vasse River.

3.5 Amenity

9. Improve visual amenity, public health and odours for residents and visitors to enjoy the Lower Vasse River.
10. Facilitate recreational and educational opportunities, which are compatible with protection of the key values of the Lower Vasse River and enhance community stewardship.

3.6 Recreation and education

11. Enhance public access to the Lower Vasse River and within the foreshore reserve, with a focus on creating linkages to the town centre and surrounding areas while protecting the river's natural values.

3.7 Culture and heritage

12. Promote understanding of the Aboriginal and European history and culture of the Lower Vasse River.

3.8 Governance

13. Develop and maintain partnerships and a collaborative approach between key stakeholders and the community when managing the Lower Vasse River.

14. Maximise opportunities for protection of the Lower Vasse River as part of future development proposals and changes in land uses.

15. Manage the Lower Vasse River with consideration to other water assets, including the Vasse-Wonnerup Wetlands and Geographe Bay.

16. Improve knowledge and understanding of key values and management issues of the Lower Vasse River to support adaptive management.

4 Review of Management Options

Development of management strategies for the Lower Vasse River has involved consideration of a range of potential initiatives. Some are fundamental approaches such as catchment nutrient reduction and riparian vegetation management. Intervention options have also been considered to directly manage water quality problems. These options are important due to the long-term nature of achieving nutrient load reductions, and the potential for ongoing release of nutrients from accumulated sediments.

The independent review identified the need for solutions that directly reduce nutrient availability for algal growth, alter physical conditions to make it more difficult for algae to grow, or dredging the sediments (Hart 2014). In addition, the *Community Views* session also provided suggestions for future management options (Figure 14). These reflect long-held community opinions and are aligned well with the options considered for inclusion in the management strategies and actions in this WMP.

This section outlines existing information, challenges and likely outcomes from potential management options. This review was an integral step in the development of strategies and actions for the WMP, outlined in Section 5.

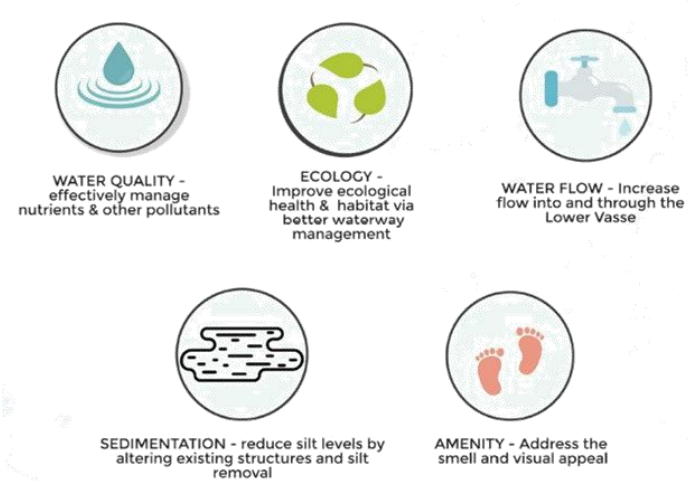

Figure 14. Suggestions for the future management of the Lower Vasse River from the *Community Views* session (AHA 2016).

4.1 Living Streams

The term *living streams* describes an approach to managing urban stormwater that creates a complex ecosystem with outcomes for ecology, water quality, water conveyance and amenity. Although traditionally applied to urban stormwater drains, this approach of restructuring the ecosystem is also relevant to restoration of the Lower Vasse River. In this case it would involve altering the morphology to restore ecological processes and create physical conditions that provide greater resilience to high nutrient conditions.

A living streams approach would see creation of diverse habitats including seasonally dry areas, river pools, channels, floodplain areas, riffle zones and islands (floating and grounded). Creation of these habitats would have clear outcomes for ecology, and the potential to provide significant water quality benefits. Compartmentalising the river by creating seasonally dry areas during summer also provides opportunities to stage works and target intervention actions. Figure 15 provides an example of changes to river form with a living streams approach.

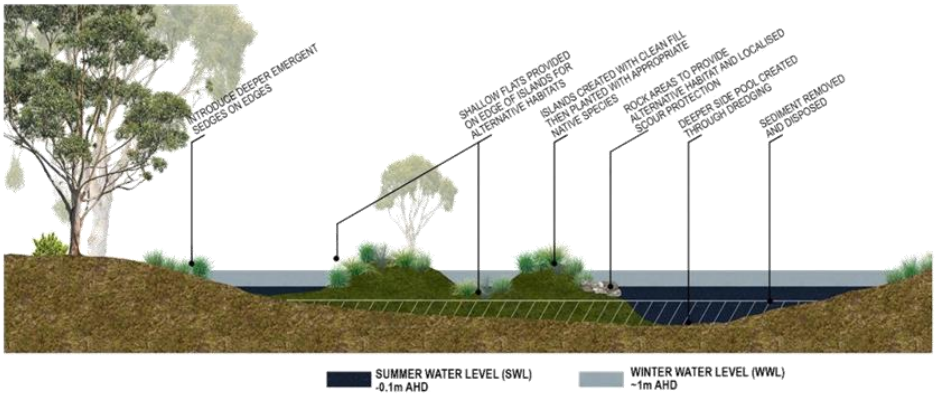

Figure 15. An example of altered river morphology with a living streams approach. More diverse habitats would be created including channels, pools, islands and seasonally dry areas.

4.1.1 Ecological outcomes

As outlined in Section 0, the Lower Vasse River supports many terrestrial and aquatic fauna despite its degraded status. The living stream approach would create new riparian habitat to support birds and possible other terrestrial fauna. Within the river, the increased surface area and diversity of aquatic habitats and food sources is likely to have a profound effect on aquatic invertebrate communities. This has been shown in the river in regard to aquatic plants (Paice et al. 2016, Paice 2018). Physical substrates (e.g. rocks, sand, and logs) and varied flow conditions will also support greater diversity. The plant and invertebrate communities in turn provide food resources for fish and birds.

4.1.2 Water quality outcomes

Potential water quality benefits of ecosystem restructuring through a living streams approach are summarised below. While these mechanisms may not achieve significant water quality improvements

individually, combined they have potential to create a more complex ecosystem that is less prone to seasonal dominance by phytoplankton. Enhanced nutrient processing capacity may also benefit downstream wetlands.

a) Aquatic plants: Modifying the depth profile and enhancing substrate can provide more favourable sediment and depth conditions for anchorage and growth of beneficial aquatic plants (macrophytes). These plants may re-establish naturally or can be transplanted. A macrophyte restoration trial in the river in 2012 did not result in water quality improvement (Paice et al. 2016), however the mechanisms by which these plants contribute to water quality are well known throughout the world (Van Donk and Van de Bund 2002; Davis et al. 2010). Interestingly the Mexican waterlily has shown water quality benefits, although it is not clear how. Aquatic plants contribute to improved water quality through:
   - competing with algae for nutrients, both directly and by supporting biofilm;
   - stabilising and oxygenating the sediments;
   - supporting organisms that graze on algae; and
   - chemical inhibition (allelopathy).

b) Freshwater mussels: Carter's Freshwater Mussel (*Westralunio carteri*) is a listed threatened species known to occur in the river. Modifying substrate or providing additional substrate could increase mussel populations. They are thought to play an important role in maintaining water quality in refuge pools through filtration (Caraco et al. 2006). Mussels in the Lower Vasse River have a habitat preference for bridge sites and river edges, which are more shaded and stable.

c) Benthic algae: Increasing surface area by creating a more complex river form with greater rock and wood surfaces would allow benthic algal populations to establish. These communities are alternative primary producers to phytoplankton, competing for nutrients and providing an important food source for aquatic fauna, so that nutrients are incorporated into the food web. Emergent wood and rock materials also provide habitat for birds.

d) Emergent plants: Reshaping river banks could provide ledges for establishment of more emergent plants through revegetation. These plants use up nutrients, shade the water, trap sediments and provide excellent habitat and food for waterbirds. They are more beneficial than rushes on the upper banks because of stronger interaction with river sediment and water column. Some emergent plant beds have been created in previous restoration efforts, but they are confined to very thin riparian strips.

e) Floating islands: There have been a number of vegetated floating islands trialled in the Lower Vasse River. These islands provide habitat, both above and below the water and may contribute to nutrient uptake and processing through growth of plants and associated biofilm. Some products include a nutrient holding media in the island structure, although effectiveness is uncertain. These structures also provide an immediate shading benefit, restricting algal growth. This shading function may also be useful in restricting the spread of waterlilies (4.5).

f) Changing morphology: Physical modifications that increase surface area and creates seasonal separate wetland compartments may have several advantages, including:

- greater resilience to higher nutrient loading due to greater surface area for beneficial processes;
- higher levels of shading, providing less favourable conditions for algal blooms;
- reduced wind fetch and thus nutrient-release and turbidity from resuspension of sediments;
- potential for water circulation within or between pools, reducing residence time for development of algal blooms; and
- opportunities for targeted interventions to address water quality such as sediment removal (Section 4.11) and water treatment (Section 4.3).

4.1.3 Challenges

Modification of river morphology as part of a living stream approach would involve extensive earthworks that affect hydrology (and flooding) and existing riparian and aquatic habitats. Design will need to address constraints of these issues, and several approvals will be required (Calibre 2018). In particular, Carter's Freshwater Mussels occur in the river. This is a recently listed (2018) threatened species[3] and so will require approval and management of in-river works to minimise mortality and create a net benefit for this species.

Implementation of living streams works would involve considerable cost associated with sediment removal and infill. It has been difficult to develop reliable costings for this approach, owing to variation in potential designs; and uncertainty in volumes and methodology for sediment removal and disposal, and materials used for infill. Costs and uncertainty can be addressed through staging of works, allowing development of reliable methods and better understanding of materials. Adaptive implementation in stages based on results will improve overall outcomes.

4.2 Reducing nutrient sources

Management of nutrient inputs from urban and agricultural catchment areas is addressed in the Water Quality Improvement Plan (WQIP, DoW 2010), which is currently being reviewed. The WQIP outlines management measures and provides recommendations, which are included in the Management Strategies for this WMP (WQ1 and WQ2).

A large proportion of the catchment with agricultural landuse (approximately 90%) is currently diverted via the Vasse Diversion. Nonetheless, flows from the broader rural catchment do impact water quality in the Lower Vasse River. Increasing flows from the Vasse Diversion to the Lower Vasse River (Section 4.8) would increase nutrient loads from this source. There are also some rural land use activities remaining in the Lower Vasse River catchment area.

GeoCatch, supported by DWER, has a strong focus on nutrient reduction in agricultural areas, supporting implementation of best management practices for fertiliser use and dairy effluent management, and soil amendments. They also promote and assist riparian management and stock control on waterways. There are opportunities to improve management of the extensive modified drainage networks, which rapidly convey nutrients and sediments within the catchment. This is the

[3] Listed as threatened under Wildlife Conservation Act 1950 (Western Australia); listed as vulnerable under Environmental Protection and Biodiversity Conservation Act (1999) (Commonwealth); listed as vulnerable under Global IUCN Red List of Threatened Species.

focus of the *Rethink Drainage* action area for the RGW program. These management initiatives are important to the long-term reduction of nutrient contributions to the Lower Vasse River from rural sources.

Much of the Lower Vasse River catchment is urban, and these areas will continue to expand with future development, creating new sources of nutrients. In existing urban areas, the City has worked in partnership with GeoCatch to implement significant stormwater management upgrades throughout the Busselton CBD and LIA areas (Appendix 3). These include:

- biofiltration beds
- rain gardens (Figure 16)
- enhancement of natural wetlands
- constructed wetlands
- vegetated swales
- biofiltration swales
- detention basins

There may be more opportunities for stormwater upgrades in the Lower Vasse River catchment, and a process to identify and prioritise future projects would be beneficial.

Inclusion of best practice water management technologies in new developments will be essential to minimise future nutrient inputs. The City has a key role through its planning and development approvals processes to ensure this occurs. The *Better Urban Water Management Framework* (BUWMF) provides guidance ensure consideration of water resource management in the planning process (Section 4.13).

Sewerage infrastructure has a major role in protecting water quality in the Lower Vasse River, diverting nutrient- and pollutant-rich waters to the Busselton Wastewater Treatment Plant. Not all properties are connected to existing sewerage infrastructure, and there may be opportunities to increase connections within the Lower Vasse River urban catchment areas, reducing nutrient exports from these areas.

The Busselton Light Industrial Area (LIA) is currently not connected to sewerage infrastructure. Septic tanks in the LIA are estimated to contribute about 10% of the phosphorus load and 4% of the nitrogen load to the Lower Vasse River annually (DoW 2010). However, there is limited data available to base these estimates on. Development of infill sewerage infrastructure in the LIA has a high potential cost and requires clear evidence to be progressed. This would be assisted by investigation of nutrient and pollutant exports, and an audit of waste in relation to acceptable criteria.

Figure 16. Example of a rain garden for stormwater quality management, at the City Administration building.

4.3 Water treatment

Reducing nutrient inputs is a fundamental management approach, but significant reduction in nutrient loading from diffuse sources in the catchment is difficult to achieve and takes many years. In highly eutrophic systems, such as the Lower Vasse River, reducing nutrient inputs alone is unlikely to prevent algal blooms because of the ongoing supply of nutrients form the sediments. Intervention options to limit nutrients available to algae and to treat algal blooms may be necessary to achieve short term water quality improvement. The main limitations of these options are uncertainty in effectiveness, costs of large scale treatment, and short-term effectiveness.

4.3.1 Water treatment using specialised clays

"Water treatment trials" in the Lower Vasse River have focussed on specialised clays. Covering the sediments with specially-developed material can prevent nutrient release and reduce nutrients available for algal growth. These products are applied as a slurry and settle through the water column to form a layer on the surface of the sediments. Applied in this way, these products can bind to and sink nutrients and algal cells as they settle through the water column (Figure 17). There are a number of clay products used commercially and experimentally in a global context. Three have been trialled in the Lower Vasse River: Phoslock™, flocculating clays, and hydrotalcite clay.

From 2001-2004, three trials of Phoslock™ were completed. Application during an existing algal bloom can substantially reduce available phosphorus but had no effect on the algal bloom. Application prior to establishment of the algal bloom reduced both phosphorus levels and limited algal growth by 80%, although a less severe algal bloom still occurred (Robb et al. 2003). Application rates for Phoslock™ are well-understood and it is a commercially available product. It needs to be applied prior to establishment of an algal bloom, to restrict growth by reducing phosphorus availability.

Two types of flocculating clays have been trialled in the Lower Vasse River. Application of a clay mixture containing polyaluminium chloride in April 2000 had no overall positive effect on river appearance. An experimental clay product was applied to a small contained area in February 2002, which did show visible improvement in water quality, but little monitoring was done.

Hydrotalcite clay (HT clay) has been the focus of more recent trials in the Lower Vasse River. Like Phoslock, this product is applied as a slurry and designed to strip phosphorus from the water column and trap phosphorus by forming a layer on the sediment surface. A mesocosm study was undertaken during 2006-17; followed by a larger scale field experiment in 2017-18. The results of these trials indicate reductions in phosphorus concentrations and algal growth (DWER 2018c). Unfortunately observed water quality remained poor in the trial areas, with the water still having a green appearance. More work is required to determine appropriate dosage levels, and this product is not widely available.

In general terms, these products have not demonstrated prevention of algal blooms, but have shown some success in reducing algal growth. Their effectiveness is limited by ongoing external nutrient inputs, so ongoing applications are needed and they are costly. DWER currently recommend annual treatment of the lower reach of the river with Phoslock™, at an estimated cost of $120,000 per year.

Targeted treatment may be possible in smaller, seasonally-isolated areas following implementation of living streams works. This would make multiple applications more affordable. An ongoing interest in future development of these products should be maintained as they are improved and developed commercially.

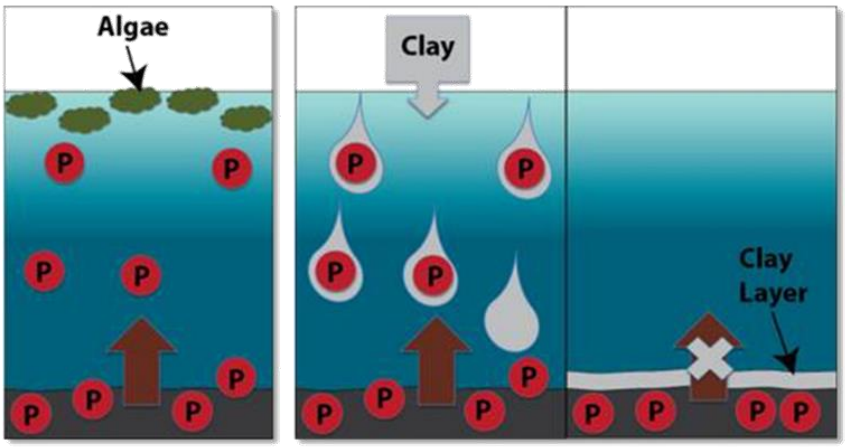

Figure 17. Phosphorus-binding clay products such as Phoslock® or the new HT-clay lock up phosphorus, making it unavailable to algae. Phosphorus is removed as the clay settles through the water and it also forms a protective layer on the sediments, reducing phosphorus release. Figure Courtesy DWER.

Figure 18. HT clay being applied in the Lower Vasse River during the 2017-18 trial.

4.3.2 Oxygenation and aeration

Oxygen is important for aquatic fauna and also influences nutrient availability. Low oxygen levels can be artificially increased by pumping oxygen gas into the water and by aeration. Both these methods will result in increased oxygen levels in the water, although oxygenation is more effective and aeration may increase nitrogen concentrations (due to nitrogen content of air). Increasing oxygen levels improves conditions for aquatic fauna and promotes aerobic biological processes, which can address odour issues.

Low oxygen conditions at the bottom of the water facilitate release of phosphorus from the sediments, which contributes to algal blooms (Boulton et al. 2014). This situation occurs when there is little mixing and the water column is stratified. In this situation, oxygenation, aeration or artificial circulation can reduce phosphorus release from sediments into the water.

The Lower Vasse River is not stratified, and has high oxygen levels throughout the water column during summer when the algal bloom is established. Algal blooms increase oxygen levels to above 100% during the day through photosynthesis. Although respiration at night consumes oxygen, it does not cause deoxygenation. The water is shallow enough to be mixed by the wind. Oxygenation and aeration of the water column would therefore not address nutrient problems in the Lower Vasse River when an algal bloom is established. The sediment is anoxic, but these methods do not oxygenate the sediments, and an attempt to do so would cause considerable resuspension of sediments.

Oxygenation was trialled in the Lower Vasse River during the summer of 1998-99 to determine the effectiveness of the process and water quality outcomes. There was no effect on the established algal bloom, although increased oxygen levels were observed and considered beneficial for aquatic fauna. Greater understanding of oxygen fluctuations prior to the onset of the algal bloom when oxygen levels would help assess potential advantages of oxygenation lower in the Lower Vasse River.

In addition to increasing oxygen levels, mixing of the water through aeration combined with sufficient circulation may influence algal growth by reducing the residence time. Phytoplankton thrive in the still conditions of the Lower Vasse River during summer. Movement of water within the system has potential to limit algal blooms by physical disturbance and reducing water temperatures (Cha et al. 2017). Artificial mixing is a common management practice in lake restoration, both to address stratification problems and to restrict growth by entraining phytoplankton in flow, and can restrict growth of scum-forming blue-green algae (Visser et al. 2016).

4.3.3 Water treatment using microbiological products

A number of commercial products exist that claim to improve water quality through the introduction or enhancement of micro-organisms. There are no scientific studies available on the effectiveness of these products. Current evidence is anecdotal only and while some benefits may have been observed in small-scale situations they have not been formally reported.

The City supported trials of two such products in the Lower Vasse River during the summer of 2012-2013:

- A microbiological culture pad product that provides high surface area and trace elements to increase the population of beneficial microbes (*Archaea* microbes and *Bacillus* bacteria).
- An enzyme protein product designed to promote bacterial growth and activity.

Water quality monitoring over three months did not show any significant effects of these treatments, however there were several limitations of the trials. There was no aeration, which is generally recommended in combination with these treatments. The trials did not take place under conditions of severe algal blooms expected, owing to the effect of Mexican waterlily downstream.

Enhanced nitrification and denitrification is described as the beneficial process by which these products improve water quality, and some effect on available nitrogen was found for the enzyme product. The Lower Vasse River generally has very low available nitrogen, which favours blue green algae because they can obtain nitrogen from the atmosphere through fixation. This product may influence the phytoplankton community by increasing available nitrogen. Reducing phosphorus availability is very important for limiting algal growth, and these products do not achieve this.

There are no published studies of the effective use of microbiological products to control algal blooms at the lake scale. They may be more effective in small isolated systems such as ponds and dams.

4.3.4 Barley Straw

Addition of barley straw is considered a preventative method for algal control that has been used extensively in farm dams and canals. Decomposing straw has been shown to inhibit algal growth in laboratory conditions (Gibson et al. 1990) and reduce filamentous algal growth in canals in years following placement (Welch et al. 1990). Barley straw bales and extracts are marketed for use in algae prevention.

In April 2000, straw bales were placed in the Lower Vasse River upstream of the Causeway Rd bridge to assess their effect on algal blooms. No effect on water quality was observed, however it is uncertain that Barely straw was used. Potential future use should consider it may be most effective at small scales; in a preventative approach; and that straw must be decomposing. It may be more effective for filamentous algae rather than phytoplankton.

4.3.5 Algaecides

A number of algaecides are marketed for treating algae, usually copper-based, but are generally not recommended for natural systems due to their toxicity to non-target plants and aquatic fauna. Hydrogen peroxide is marketed as an algaecide which has high specificity for blue-green algae and no residual impacts on the environment as it breaks down to hydrogen and oxygen gases. Some research supports its potential as a management tool for algal blooms (Matthijs et al. 2012, Bauza et al. 2014). It has been used to control blue-green algae in small lakes and wastewater treatment ponds, but is not widely used for larger systems for a number of reasons:

- difficulty in achieving and maintaining required concentrations throughout water body;
- potential impact of hydrogen sulphide on other organisms, mainly zooplankton;
- potential for release of toxins such as microcystins from dying algal cells;
- lack of residual effect (regrowth of algae following treatment).

Trials of hydrogen peroxide in Lake Torrens[4] in South Australia have not been formally reported. Information provided suggests effective reduction of blue-green algae at H_2O_2 concentrations of 2-5 mg/L, with no impacts on aquatic fauna. However these trials were conducted at low algal cell densities (below algal bloom levels), and the current recommendation is for small scale use in combination with other methods. SA Water continues to investigate this method for reservoir management.

4.3.6 Ultrasound

Ultrasonic control of phytoplankton is commonly used for pond environments and works by destruction of algal cells. Its effectiveness has been demonstrated in small scale studies and laboratory experiments, but upscaling this treatment to field conditions is challenging (Park et al. 2017). Frequency, intensity and exposure are important factors in effectiveness, and may have variable effects on different algal species. There has been a successful trial in a 9000m^3 pond in combination with pumping, but could not differentiate the effects of ultrasound and the pumps (Ahn et al. 2007).

4.4 Riparian vegetation management

In addition to the conservation value of the flora itself, fringing vegetation of wetland areas is a vital component of river health. Functions include:

- supporting terrestrial and aquatic food webs;
- habitat for terrestrial and aquatic fauna;
- foreshore stabilisation;
- shading and maintaining cooler temperatures
- interception of nutrients and sediments in runoff; and
- nutrient uptake and processing.

Riparian vegetation along the Lower Vasse River provides important bird habitat and forms part of a regional ecological linkage mapped along the length of the study area (Ecoedge 2017). However the vegetation is mostly degraded with low species diversity and extensive weed invasion. There has been

[4] Information from unpublished report and discussions with local NRM group Natural Resources Adelaide and Mt Lofty Ranges.

considerable riparian revegetation on the Lower Vasse River banks since 1999, and these areas provide the best condition riparian vegetation. This demonstrates successful revegetation, but these areas need more active weed control and could be enhanced with infill planting.

Extensive areas of public lands provide good opportunities for revegetation. Ecoedge (2017) suggests five key areas for rehabilitation based on size, accessibility and level of competition with existing plants (Appendix 3. Additional areas of City-managed foreshore reserve are being created through new developments, providing new opportunities for improving riparian vegetation. The littoral zone[5] could be expanded in some areas through a living streams approach, including zones of seasonal and permanent inundation, requiring a specialised suite of species. A species list for revegetation for terrestrial and aquatic areas is provided in Appendix 4.

Outside of urban areas there is still stock access to some foreshore areas, damaging fringing vegetation and directly contributing wastes to the river. The *Vasse River Action Plan* study area extends from the headwaters in the Whicher Range to Fairlawn Road (Scott 2000). It provides an assessment of foreshore condition and identifies areas requiring management of stock access, weed control, erosion control and revegetation. A review of implementation of the Action Plan and an update of the foreshores assessment and associated management recommendations for the Lower Vasse River WMP study area would assist in planning and undertaking restoration activities. This would also set a baseline for future monitoring of progress and outcomes. River action planning should also include consideration of future development and provide information to assist in planning for additional foreshore reserves.

Figure 19. Improving riparian revegetation through weed control and infill planting.

Figure 20. Floating island on the Lower Vasse River installed in 2002.

[5] The ecological zone in freshwater systems close to the shoreline where sufficient light extends to the bottom for plant growth (Boulton et al. 2014).

4.5 Floating Islands

Floating islands are also known as constructed floating wetlands, as they are designed to provide the ecological engineering benefits of constructed wetlands designed for water quality improvement. They are used in water treatment systems, particularly in China, and can contribute to restoration of natural waterbodies, however their effectiveness in pollutant removal is lower at larger scales (Bi et al. 2019). Floating islands have potential to remove nutrients from the water column, and they provide ecological benefits of habitat and shading.

Islands consist of a floating frame or structure supporting a contained media within which plant roots can grow. The plants and media combined enhance microbial processes that have potential to reduce nutrients in the water column. They may be more effective at nitrogen reduction than phosphorus: nitrogen is removed via enhanced nitrification and denitrification, while phosphorus is stored internally and remains potentially available. As plants grow they take up nutrients from the water, however this only contributes to ongoing nutrient removal plants are regularly harvested.

The shading effect of floating islands has immediate benefits of reducing lower water temperatures and light availability to algae, although the scale of islands needed for this to limit algal blooms may be unfeasible. The structures have potential for use in restricting growth of Mexican waterlily by shading, while retaining beneficial biological processes. Islands and the roots below provide structural habitat for aquatic invertebrates, increasing biodiversity and improving food resources for other aquatic fauna. They also provide refuge from heat and predation from waterbirds.

Some small floating islands have been placed in the river in the past. In 2002 a small reed raft was made from a PVC frame with plastic mesh base (Figure 20). Plant growth was rapid, and the structure was subsequently used for nesting. This 'island' remains in the river today and has become rooted to the bottom of the river. Swans have recently been observed nesting on it. In 2012 floating islands were installed in a curtained off area to assess water quality benefits. The trial did not take place under conditions of severe algal blooms expected, owing to the effect of Mexican waterlily downstream. No significant effects on water quality were found in this trial, however the beneficial ecological processes associated with floating islands are well-established.

4.6 Managing waterlilies

The extensive cover of waterlilies in the river has negative impacts on oxygen levels and open water habitat; however they appear to have had a beneficial effect on water quality, inhibiting the development of algal blooms in open water areas upstream of the point of infestation (near the boat ramp) (Paice 2018). The structural habitat of the waterlilies also supports aquatic invertebrates, despite low oxygen levels.

Although unintentional, this is an example of "ecological engineering", whereby a change in the ecology has provided water quality benefits. The reasons for reduced algal blooms between patches of waterlily are not fully understood. It is not a result of reduced phosphorus concentrations, as phosphorus was actually extremely high in areas with low algal growth. It may be a combination of greater low residence time in sunlit areas owing to lilies and riparian shading; nitrogen limitation; or chemical inhibition (allelopathy). Understanding the mechanisms by which waterlilies inhibit algal growth may provide important insights to future management, and warrants further research. It

would also be valuable to investigate the potential to achieve similar inhibition using native aquatic plant species, such as *Cycnogeton* spp., *Potamogeton* spp., *Liparophyllum* spp. and *Ottelia ovalifolia*.

Reduced algal growth was observed following a rapid expansion of waterlily cover in 2013-2014 (Figure 9), at considerably lower levels of cover than subsequent years. This suggests that water quality benefits can be maintained with some control of waterlily. Large scale control would likely see a return to widespread seasonal algal blooms; and also presents risks of widespread deoxygenation following plant die-off. Paice (2018) recommends strategic control of waterlily to gradually reclaim open waters between lily patches, targeting important waterbird habitat, and to prevent invasion of new areas. Although outside the study area of the WMP, the downstream Lower Vasse River delta wetlands are at particular risk and should be targeted for waterlily control.

4.7 Controlling feral fish

The two main feral fish species in the Lower Vasse River are goldfish and mosquitofish. There is little that can be done to control mosquitofish populations. Goldfish are known to feed in at the bottom of the river, disturbing sediments and so contributing to nutrient release and turbidity. There is also evidence that passage through goldfish stomachs can increase the growth rate of blue-green algal cells.

Although eradication of goldfish is difficult, population numbers were successfully reduced through an annual electrofishing program from 2003 to 2013 (Beatty et al 2014). The resumption of this program should be considered. Compartmentalising the river may provide opportunities for effective targeted goldfish removal.

4.8 Increasing flow inputs from the Vasse Diversion

Reduction in catchment flows due to interception by the Vasse Diversion, together with impoundment by the Butter Factory weir boards have substantially altered hydrology of the Lower Vasse River. The effect on nutrient concentrations is complex due to variation in nutrient concentrations and the combined results of flow volume and velocity, assimilation within the system and outflows. Although nutrient loads may have decreased due to lower volumes, this does not translate to lower nutrient concentrations.

The impounded conditions and accumulated sediments in the lower 'lake' section of the river promote algal blooms which causes a seasonal increase in nutrient concentrations over summer when there is negligible flow (Section 2.1.1). Flushing of the river may be important for removing nutrients and organic material that accumulate in during summer (Figure 6).

There is strong support from the community for increasing flow into the Lower Vasse River from the Vasse Diversion with the aim of improving water quality. Altering flows has potential to improve water quality where it dilutes nutrient concentrations or reduces residence time for growth of algal blooms. But outcomes need to be considered in the context of flood protection and impacts on nutrient loads to downstream wetland ecosystems. This option of altering flows was investigated by the *Reconnecting Rivers* study (DWER 2018b), which used hydrological modelling to determine the outcomes from a range of reconnection scenarios. The main findings of the *Reconnecting Rivers* study in relation to the Lower Vasse River were:

- the Vasse surge barrier is essential for flood prevention in Busselton;

- additional flows from the Vasse Diversion would increase nutrient loads to the Lower Vasse River and Vasse Estuary;
- an additional 900mm culvert at the Vasse Diversion offtake to the Lower Vasse River is feasible without increased flood risk and without unacceptable additional nutrient loads to the Vasse Estuary;
- the equivalent of three 900mm culverts or full reconnection of the Vasse Diversion would cause unacceptable flood risk and increase in nutrient loads to the Vasse Estuary;
- additional flows from the Vasse Diversion only has a significant effect on flows during winter;
- the potential effect of an additional culvert on summer water quality in the Lower Vasse River is small because of a lack of flow;

The study recommended that the Vasse Diversion Drain offtake structure be upgraded to an equivalent of two 900mm culverts (i.e. double its current capacity), with the ability to control flow. This infrastructure has been designed and works are currently scheduled for 2019. *Reconnecting Rivers* also recommended the development of an operational strategy to manage the culverts, with defined roles and responsibilities and consideration of how nutrient concentrations could be minimised. A greater understanding of relationships between water flow and water quality wold be beneficial to inform optimal operation of the culvert with regard to nutrient management.

4.9 Improving summer flows

There is no flow from the Vasse Diversion in the warmer months to address water quality problems during the algal bloom season through dilution and water movement (DWER 2018b). There are limited other options for creating summer flows with other water sources. These are summarised as follows:

- Storage of water for summer release: A dam to hold water for summer release would need a capacity of 18GL and cover an area of 9km^2. Water stored in such a reservoir is at risk of experiencing similar water quality problems to the Lower Vasse River. Using the Vasse Diversion or existing flood detention basins is not viable as it would compromise their flood protection function (DWER 2018b).
- Busselton Wastewater Treatment Plant discharge: This option would reduce water residence time and may decrease phosphorus concentrations with limited increase in loads to downstream wetlands (DWER 2018b). This option may be considered further, but its practicality is limited by need for substantial infrastructure and future competition for this water resource.
- Busselton Water operations: There may be potential for backwash inputs, but this has not yet been assessed.
- Internal artificial circulation: Movement of water within the system has potential to limit algal blooms by physical disturbance, reducing water temperatures. Temperature and residence time can be key factors controlling algal blooms in impounded rivers suggests (Cha et al. 2017). This approach may provide opportunities for external treatment techniques associated with recirculation (e. g. filtration via treatment wetlands). This option has not been assessed.

4.10 Removal of the Butter Factory weir boards

The Butter Factory weir structure and boards were installed around 1918 to retain water levels in Busselton for amenity and recreation outcomes. There are mixed perceptions regarding their

necessity: that removal would improve water quality in the river through flushing; that they are not necessary and greater drying would be beneficial; and that maximising depth is important to improve water quality by creating cooler conditions.

Current management practice is to remove the weir boards in winter, and reinstall them in October to maintain water levels. However, the wooden boards currently leak, so higher water levels are only maintained temporarily. From around December, the extent of water is determined by land elevation, and currently restricted by a point further downstream near Ford Rd.

Modelling through the Reconnecting Rivers project indicated that removal of the weir functionality would not create a flooding risk; and would not result in drying out of the river. This approach may have the following outcomes:

- water levels in the Lower Vasse River would become lower earlier, by up to eight weeks;
- water would continue to flow into the downstream wetlands for a longer period, rather than being held back, influencing nutrient load;
- potential effects on goldfish movement.

An important operational issue at present is the safety of City staff during the installation and removal of the weir boards. A decision is required as to their future use, because if they are necessary part of river management they will need to be replaced and the mechanism for their installation and removal upgraded.

4.11 Sediment removal

Regardless of potential reductions in nutrient loads, the organic sediment in the Lower Vasse River provides an ongoing internal source of nutrients loading that can continue to drive algal blooms. Phosphorus is released from the sediments under low-oxygen conditions, and nutrients are also resuspended from the sediments when disturbed by flows and wind. Increasing phosphorus concentrations over the summer months may be a result of sediment-nutrient release. Note that specialised clay products are a form of sediment treatment that prevents phosphorus release (Section 4.3).

Sediment removal has long been viewed by many stakeholders as an essential part of future management. It was highlighted as a key management action during community consultation (AHA 2016). As a stand-alone method it would probably not prevent algal blooms, because nutrient concentrations in surface and groundwater inputs are sufficient for excessive algal growth. However, “resetting” the river through removal of organic sediments does have potential outcomes for water quality and ecology.

Outcomes of sediment removal for river health are complex. Increasing depth may create cooler temperatures but can also result in stratification if there is little mixing of the water, so there may be little temperature-related control of algae. Deeper waters may also reduce resuspension of nutrients from the riverbed. However, shallow waters may also be less prone to algae blooms owing to more favourable conditions for aquatic plants and benthic algae. Rather than removing all soft sediments from the river, creation of deeper pools and channel habitats in some areas as part of a living stream approach is considered more feasible (Section 0).

A section of the river upstream of Causeway Rd Bridge was dredged in March 2001. This work has increased the depth of the river in this section, however a large amount of soft sediment remains, at

thickness similar to other parts of the river, and water quality remains poor (Paice 2005). In this case a mini-dredge was used to pump material to a holding dam, allowed to settle overnight and then overlying water was returned to the river. Sediment from the dam was disposed of at a gravel pit.

4.11.1 Removal method

Sediments in the Lower Vasse River are very fine and contain a high moisture content, and so require pumping from the river rather than excavation. The method used in 2001 was effective in removing some sediment and allowing it to dry out sufficiently for excavation. However drying took a considerable length of time and the total amount removed was dependent on the capacity of the holding dam. A more recently developed option is pumping sediments into porous geotextile bags placed nearby (Figure 21); with addition of a polymer to expel the water from the bags, which flows back into the river. This approach allows additional sediment to be pumped from the river as the volume of water is removed from collected sediments. This is considered the most feasible option for sediment removal from the river, and a proposal for a trial is currently being developed.

4.11.2 Disposal options

Disposal of dredged sediment is challenging in terms of potentially very large volumes, involving considerable transport costs; and limitations on disposal site owing to potential acidification and nutrient and pollutant content. To inform disposal options, the City undertook sampling of between the boat ramp on Southern Drive and the Butter Factory weir in March 2018, with assistance from DWER.

Levels of heavy metals and organic and inorganic contaminants were below threshold levels for disposal at a Class I landfill facility, with the exception of lead (Table 3). Although lead content levels were above threshold values for waste not requiring a leach test, subsequent leachate testing results showed levels were well below the Class I concentration limit.

The average depth of soft sediment in core samples was 488mm, with these sediments dominated by fine silts and clays (71.4%). Sample analysis found no existing acidity (mean pH 7.0), and low acid volatile sulphur (<0.005 %S) but indicated sulfidic soils with very high potential acidity. Net acidity varied greatly, ranging from 449 to 1511 with a mean value of 980 mole H+/Tonne dry weight. This is well above the acid sulphate soils 'action criterion' of 62 mole H+/T for fine texture materials (DER 2015). When sulfidic soils are exposed to air, oxidation can result in acidification. This has been demonstrated for the dredged material from 2001 at the gravel pit, which has a pH of around 4. The average lime dosing required to buffer potential acidification is 74kg/Tonne dry weight.

Soil characteristics do show that dredged material could be disposed of at a Class I landfill facility, such as the City's Vidler Road Waste Facility. However the high nutrient and organic content of the material suggests potential for reuse of the material as a component of compost. Composting can further dilute concentrations of pollutants. This approach would require a trial and further testing of the material to ensure it is safe for any proposed end use.

4.11.3 Risks

The main risks associated with sediment removal are:

- potential impact on benthic organisms;

- short term effects on water quality;
- acidification of sulfidic sediments; and

In the Lower Vasse River the soft sediment layer general provides poor habitat for benthic organisms. However the threatened Carter's Freshwater Mussel (*Westralunio carteri*) is known to occur. Mussels in the Lower Vasse River have a habitat preference for bridge sites and river edges, which are more shaded and stable. Key habitat areas could be avoided and work could be offset by overall habitat improvement; but nonetheless sediment removal work would need to consider and manage impacts on this species and be approved under state and federal legislation.

There is some risk of increased nutrient concentrations in the vicinity of dredging operations disturbance of nutrient rich sediments. Given the severe water quality problems currently experienced in the river this is not considered to be a serious risk. However the connectivity to the Vasse Estuary downstream does raise the issue of impacts on nutrient loads. This could be avoided by undertaking work when the river is disconnected from the downstream system.

The soft sediments in the Lower Vasse River are sulfidic and laboratory analysis and the pH of the old dredge spoil do indicate that oxidation would cause acidification. Severe acidification can have direct impacts on aquatic flora and fauna, lead to contamination of water resources, and cause corrosion of infrastructure. Exposure of the sediments to oxygen in the water column or air would be avoided using the geotextile bag method, preventing oxidation during the removal process. The sediments are not monosulfidic (indicated by low acid volatile sulphur); so do not pose the risk of rapid acidification and associated deoxygenation of the water column with potential heavy metal release. Sediments would require lime dosing for disposal.

Table 3. Comparison of pollutant content of Lower Vasse River sediments to threshold values for Class I landfill (sampling by City, March 2018).

Analyte	mean	Class I landfill threshold[1]	Units
Arsenic	<5	14	mg/kg
Beryllium	0.1	2	mg/kg
Cadmium	0.34	0.4	mg/kg
Chromium	6.6	10	mg/kg
Lead	35	2	mg/kg
Lead leachate	<0.01	0.1	mg/L
Mercury	0.04	0.2	mg/kg
Molybdenum	<2	10	mg/kg
Nickel	2.00	4	mg/kg
Silver	<1	20	mg/kg
Fluoride	137	300	mg/kg
Cyanide - Total	<1	16	mg/kg
Petroleum hydrocarbons C_{6-9}	<0.2	2800	mg/kg
Petroleum hydrocarbons – other	19.5	450[2]	mg/kg

[1] Landfill Waste Classification and Waste Definitions (DEC 2009)
[2] minimum threshold value for range of petroleum hydrocarbons
< indicates value below limit of detection
Phenol and pesticide suite also analysed, all results below limit of detection

4.11.4 Costs

There is uncertainty around costs for sediment removal, related to volumes of material and potential shrinkage, method of removal and options for disposal. Further work is required to provide accurate estimates of sediment and determine sound methods for removal and disposal. Removal also needs to consider appropriate locations and whether it could be staged in association with a living streams design approach. The removal trial currently being developed (see 4.11.1) will inform future costings of this management option.

Figure 21. Geotextile bags used for sediment removal via dredging.

4.12 Recreation and access management

Recreational opportunities for the Lower Vasse River are mainly walking and riding along the river and bird watching. Feeding of ducks and other birds near Peel Terrace is also common, but is discouraged owing to potential impacts on water quality and bird behaviour. Recreation is clearly limited by water quality problems. Algal blooms pose a health risk that prevents direct contact activities such as swimming and use of paddle craft; and at times cause poor odours that limit activities near the water. Management actions that address water quality are thus essential to improve recreational opportunities.

There is potential to improve access and facilities for recreation and enjoyment during periods where algal blooms do not occur, or do not cause offensive odours. Community consultation indicated access and recreation as the area of management where the community would most like to see change (AHA 2016). Examples include additional pathways, boardwalks, viewing platforms, seating, bird hides and picnic areas. Upgrading of interpretive signage would also encourage people to the river and enhance their experience. There are existing pathways along the river in the vicinity of Peel Terrace and

Southern Drive, and among the nearby New River Wetlands: the City is currently developing plans for an extension to this network.

There is also a need to review the use of permanent warning signs around the river, which discourage activities when there is no public health risk. This is particularly important if water quality improvements are achieved.

There is significant potential for improved recreational, amenity and cultural connection with the river. Although poor water quality does limit these outcomes, it does not prevent it. Enhancing ecological values of the river and opportunities for community connection can be achieved independent of water quality improvement. Furthermore, there are many months of the year when water quality does not pose a health risk. Clearly though, water quality improvement is a key aspect of enhancing recreational opportunities.

Interpretive signage along the Lower Vasse River between the old Rail Bridge and Rotary Park was developed as part of the Lower Vasse River Cleanup Program, in the early 2000s. These signs are still in place but are outdated: some are no longer visible and some are no longer relevant. Improved interpretive facilities and information would engage more of the community and enhance appreciation and understanding of the river and its management.

4.13 Governance options

The independent review of water asset management (Hart 2014) highlighted the need for the Lower Vasse River to have a designated manager. The City was recognised as the most appropriate manager, and this has been supported by the Western Australian Government in its response to the review. It is sensible that the City adopts this role given the high public profile of the river as a part of Busselton's town centre; and the large areas of foreshore reserves under the City's management control. Although the City is responsible for overall implementation of management actions, several key stakeholders also have important roles, outlined below. These roles and responsibilities are also summarised in Table 4, in Section 6.

The flow control structures at the Vasse Diversion connection and the Butter Factory, considered vital components of river management, are generally operated by the City. However, this infrastructure is owned by the Water Corporation. The Water Corporation has given the City permission to operate these mechanisms for water quality purposes, however some uncertainty remains in relation to flood protection.

The City also has an important role in its planning capacity. The *Optimising Planning Tools* project was completed by the City, for the RGW Program, to review the potential role of planning in water resource protection (Hosken 2018). Proposals for changes in land use and new developments can trigger the imposition of new environmental protection requirements at the approval stage. This applies to both urban and rural development.

The Lower Vasse River catchment area will undergo considerable expansion of urban and industrial areas in the future, which will increase potential nutrient and pollutant sources. Continued implementation of best practice stormwater management designs, and long term maintenance of infrastructure by the City is essential to minimise water quality impacts from future developments. Future residential development will provide opportunities for improving foreshore environments as new reserves are vested in the City. Consideration of water quality protection and surface water

management in the planning process is guided by *Better Urban Water Management* document (WAPC 2008). There is potential to require new developments to demonstrate that nutrient and contaminant levels will not exceed background levels, but this would require amendment of the City's Local Planning Scheme and is restricted by a lack of water quality standards.

In rural areas, the current trend of intensification of agriculture is likely to continue into the future. Although there is a requirement for planning approval for intensive agricultural uses such as horticulture and feedlots, development applications for these land use changes are generally not submitted to the City. Improved clarity of planning approval requirements for changes in agricultural land use and new agricultural developments may increase opportunities for waterway protection requirements. The development of industry best management practices (BMPs) would provide useful criteria for planning assessment.

The City's management responsibility is generally limited to the study area and does not extend into the broader catchment. Ongoing management initiatives in the catchment, in particular to address issues of nutrient enrichment and sedimentation, are a fundamental component of waterways management. GeoCatch, with the support of DWER, is the lead manager for catchment management. The Water Corporation has management responsibility for its rural drainage network.

DWER has an ongoing role in providing support for the management of the Lower Vasse River through continued involvement in water science, modelling and monitoring. If the implementation of this WMP is to be funded through ongoing investment in a broader program for Geographe Bay catchment waterways, DWER is likely to continue to have an important project management and networking role.

The community is also an important stakeholder with potential roles in management decisions, advocacy, implementation of on-ground works and contribution to community science. Many interested community members have provided valuable assistance during the preparation of this WMP and would be valuable in ongoing collaboration during implementation. The City has a strong 'Friends of' approach to reserves management, which may facilitate volunteer involvement in actions and monitoring. Aboriginal people have expressed a desire to participate in management decisions and on-ground projects.

4.14 Research and monitoring needs

Research and monitoring are needed to enable assessment and reporting on progress of management initiatives and to fill knowledge gaps. Research outcomes need to feed back into management planning through an adaptive process. The key research areas for the Lower Vasse River are summarised below.

Water quality: Ongoing water quality monitoring is an essential part of long-term assessment and reporting for waterway health. Future research into different water treatment options to reduce nutrient availability and reduce algal growth may provide important management tools. Short-term Intensive monitoring of nutrient concentrations and flows to the river from the Vasse Diversion Drain to improve understanding of the first flush dynamics of the system would inform operation of culverts.

Water flow: Investigation of the relationship between nutrient and flows in the Vasse Diversion will help inform management decisions around operation of the culvert connection. When the culvert is upgraded, inclusion of flow monitoring in the design would support future decisions in optimising flow. Better understanding of the effects of the Butter Factory weir on water levels and water quality is also needed to determine the need for upgrading this structure.

Birds: Despite being one of the most valued characteristics of the river, bird populations and key habitat areas are not well understood. Better knowledge of birds would assist in prioritising management actions (e.g. habitat restoration) and in developing information resources for visitors. There is an opportunity for development of community-based sampling to address this gap.

Mussels: Freshwater mussels occur in the river, and have recently been added to specially protected fauna lists at the state, federal and global levels. A better understanding is needed of the mussel population, habitat requirements, potential contribution to water quality and potential impacts of management initiatives.

Mexican waterlily: The reasons for reduced algal blooms between patches of waterlily are not fully understood, and research into the mechanisms for this would provide insights for broader river management.

Sediments: Sediment removal is potentially a major part of future management of the river to address internal nutrient sources. More work is needed to develop methods of removal, determine costs, and examine potential outcomes for water quality and impacts on existing ecological values.

5 Management Strategies and Actions

The management strategies and actions included here have been developed to work towards meeting the management objectives and vision for the Lower Vasse River. Specific actions have been grouped into strategies for each of the management focus areas, although many have potential outcomes for several objectives. Living Streams is included separately, because it is an approach to management that influences implementation of actions for a number of focus areas. A framework for implementation of the WMP is provided in Section 6, including the roles and responsibilities of key stakeholders; definition of management areas; and a process for ongoing action planning, reporting and review.

5.1 Living Streams

Living Streams is separated from the management focus areas because it provides an overarching pathway for implementing management actions related to water quality and ecology. It involves altering the morphology and physical characteristics of the river to restore ecological processes and create less favourable conditions for algal blooms. It may also facilitate intervention actions, such as water treatment and sediment removal, in specific areas of the river.

5.1.1 Strategy LS1: Living streams approach

A living streams approach would see creation of diverse habitats including seasonally dry areas, river pools, channels, floodplain areas, riffle zones and islands (floating and grounded). In addition to outcomes for biodiversity in the river, these habitats would be designed to maximise potential benefits to water quality.

Management actions:

LS.3 Continue to develop Living Streams planning as a pathway for implementing ecological restoration and water quality improvement works, and assess community support for this approach.

LS.4 Incorporate the following principles into restoration planning as part of the Living Streams approach:

- maximise shading;
- enhance substrate to provide more favourable sediment and depth conditions for anchorage and growth of beneficial aquatic plants;
- modify depth contours to support more in-stream vegetation, including emergent and submerged plants, to enhance nutrient uptake and cycling;
- provide greater surface area for benthic algal populations to develop as alternative primary producers to phytoplankton;
- reduce the size of open water areas to increase resilience to nutrient loading;
- enhance habitat for freshwater mussels to maximise their role in maintaining water quality;
- reduce residence time for algal growth through flow management.

5.2 Water quality

Nutrients are a key driver of algal blooms, so ongoing load reduction actions are a fundamental part of management. However, it often takes a long time to achieve load reductions, and they may be counteracted by new developments and changes to land use. Algal blooms can also be addressed through interventions that limit nutrient availability or directly target algal blooms. They may also be managed by creating less favourable physical conditions for phytoplankton; or restoring ecosystem functions such as nutrient cycling and food web processes.

Catchment management actions in this section are closely linked with recommendations in the Water Quality Improvement Plan (WQIP: DoW 2010), which are included for reference.

5.2.1 Strategy WQ1: Protecting water quality from urban sources

The Busselton Light Industrial Area (LIA) has been identified as a potentially significant source of nutrients and pollutants to the Lower Vasse River. This strategy is focussed on improving understanding of this problem to guide future management. It also includes actions to maintain and expand best practice stormwater management to improve water quality.

Management actions:

WQ1.8 Quantify nutrient and pollutant exports from Busselton LIA to the Lower Vasse River to inform a case for deep sewerage.

WQ1.9 Explore options to secure deep sewerage for the Busselton LIA in partnership with Water Corporation.

WQ1.10 Assess opportunities for greater connection to existing sewerage infrastructure within the Lower Vasse River catchment. If there a significant opportunity exists, investigate options and incentives to increase connectivity.

WQ1.11 Planning decisions to include appropriate sewerage management requirements and best practice water management, through implementing the *Better Urban Water Management* framework.

WQ1.12 Develop a prioritised program for stormwater WSUD upgrades to maximise nutrient reduction outcomes.

WQ1.13 Support educational campaigns that aim to reduce nutrients in runoff through individual and community actions (e.g. Bay OK).

WQ1.14 Support implementation of the Vasse-Wonnerup Wetlands and Geographe Bay WQIP (DoW 2010).

5.2.2 Strategy WQ2: Reducing nutrient inputs from the rural catchment

Agricultural activities in the Vasse River catchment influence nutrient inputs via the Vasse Diversion culvert, which may increase when the culvert capacity is increased (see Water Flows). There are also some rural land use activities remaining in the Lower Vasse River catchment area. This strategy reflects catchment management initiatives recommended in the WQIP, and future management direction in improving rural drainage.

Management actions:

WQ2.3 Support projects focussed on reducing nutrient exports from rural catchment of the Lower Vasse River, as recommended in the Vasse-Wonnerup Wetlands and Geographe Bay WQIP (DoW 2010):

- *Improve fertiliser management throughout the catchment*
- *Improve effluent management at dairy sheds and feedlots*
- *Implement riparian management and stock control on streams and drains*
- *Use soil amendments on sandy soils*
- *Use perennial pastures when suitable*

WQ2.4 Explore opportunities for enhanced nutrient assimilation in rural drains in the Lower Vasse River catchment, particularly those in reserves.

5.2.3 Strategy WQ3: Water treatment

Even when substantial reductions in nutrient loads are achieved, algal blooms often persist owing to ongoing internal nutrient supply. This strategy includes remediation approaches that address in-situ water quality, by treating water to reduce nutrient levels and algal blooms.

Management actions:

WQ3.4 Incorporate outcomes from the Water Quality Treatment Trials (2016-2018) into future management planning.

WQ3.5 Undertake seasonal water treatments in priority amenity area/s prior to algal bloom establishment, ensuring physical isolation to maximise effectiveness (dependent on outcomes Water Quality Treatment Trials, 2016-2018).

WQ3.6 Maintain research partnerships to identify and investigate new technologies to treat water in the future.

5.3 Ecology

5.3.1 Strategy E1: Riparian vegetation management

Riparian vegetation provides important habitat and supports ecosystem functions that maintain water quality. This strategy directs weed control and revegetation to improve and expand vegetated areas.

Management actions:

E1.6 Develop and implement a revegetation program for City-managed foreshore reserves, considering recommended rehabilitation areas reported in Ecoedge (2017).

E1.7 Continue to impose appropriate conditions on new developments adjacent to the Lower Vasse River that ensure future vesting and revegetation of foreshore reserves.

E1.8 Include creation and improvement of habitat for birds and possums in planning riparian revegetation.

E1.9 Update the Vasse River Action Plan in partnership with adjacent landholders, and extend this throughout the Lower Vasse River study area.

E1.10 Minimise fire risks associated with foreshore reserves by: reducing growth of annual grassy weeds; and considering species type, height and planting density when planning revegetation.

5.3.2 Strategy E2: Understanding and protecting waterbirds

Although there is high community appreciation of waterbirds in and around the Lower Vasse River, there is little formal understanding of bird populations and key habitats. This strategy will improve knowledge to guide protection and enhancement of bird habitat. There is potential for community contribution to this through a citizen science approach.

Management actions:

E2.5 Undertake a survey of waterbirds of the Lower Vasse River and identify important habitat zones, with strong involvement from the community.

E2.6 Protect identified important bird habitat zones through revegetation and weed control, recognising the current role of weeds as habitat.

E2.7 Create additional habitat zones for birds by placing large woody debris emerging from the water.

E2.8 Avoid identified important bird habitat zones when planning future infrastructure, and consider nesting season when planning works.

5.3.3 Strategy E3.1 Controlling invasive species

Mexican waterlily and feral goldfish are significant invasive species in the Lower Vasse River, impacting substantially on ecology and water quality. This strategy supports ongoing control programs for these species, but recognises the role of waterlily in reducing algal blooms.

Management actions:

E3.5 Prevent of further spread of Mexican waterlily through herbicide control and/or shading.

E3.6 Undertake strategic control of Mexican waterlily to progressively reclaim areas of open water, while minimising adverse impacts and preventing a return to algal blooms in these areas.

E3.7 Undertake regular feral fish eradication activities in partnership with Murdoch University.

E3.8 Undertake targeted control of arum lily and Brazilian pepper trees throughout the Lower Vasse River study area.

5.4 Water flow

5.4.1 Strategy WF1: Optimising flows

This strategy considers potential for water quality outcomes by manipulating flow inputs from the Vasse Diversion Drain, and by increasing summer flows. Increased flow inputs from the Vasse Diversion Drain require careful consideration of nutrient loads and flood protection. While there are limited sources of summer flow, there is scope to further investigate options and benefits of internal water circulation. This could be made more feasible through the Living Streams approach.

Management actions:

WF1.7 Increase flushing of the river by installing a second 900mm culvert at outflow point from Vasse Diversion Drain, in accordance with recommendations from the Reconnecting Rivers Report (DWER 2018).

WF1.8 Monitor impacts of increasing flows into the Lower Vasse River.

WF1.9 Undertake intensive monitoring water quality in the Vasse Diversion to support operational guidelines for managing the culvert.

WF1.10 Develop operational guidelines for the Vasse Diversion culvert that defines responsibilities and provides formal guidance for manipulation of the valve to maximise water quality benefits and minimise risk of flooding.

WF1.11 Review function of the Butter Factory weir boards to inform their future use and need for replacement.

WF1.12 Investigate potential for increasing internal circulation in the system during summer to reduce residence time for phytoplankton.

5.5 Sediments

5.5.1 Strategy S1: Sediment removal

The accumulated organic sediment in the Lower Vasse River provides an ongoing internal source of nutrients that drive algal blooms. These sediments also create a hostile environment for beneficial native aquatic plants and benthic aquatic fauna. This strategy includes removing sediment through an adaptive approach over time and considers alternatives to removal.

Management actions:

S1.4 Undertake a small-scale sediment removal project, using geotextile bags for dewatering and disposal, to assess cost and logistics of this approach.

S1.5 Determine feasibility of disposal options for future sediment removal: landfill, composting, soil conditioner.

G2.4 Depending on outcomes of small scale removal, undertake staged removal of sediments in the Lower Vasse River as a component of Living Streams design.

5.6 Amenity, recreation and education

5.6.1 Strategy ARE1: Improving facilities and information

Management actions:

ARE1.6 Review existing facilities and develop a concept plan for strategic pathways and viewing points that connect people with the river.

ARE1.7 Update the interpretive signage around the river to provide information on of the history, ecology, hydrology and management of the Lower Vasse River.

ARE1.8 Develop online and printed resources with interesting and important information on ecology, water quality, history and management of the Lower Vasse River.

ARE1.9 Establish bird watching areas and hides in appropriate places with informational material.

ARE1.10 Encourage opportunities for citizen science to contribute to understanding and appreciation of the Lower Vasse River.

5.6.2 Strategy ARE1: Public health management

There are many months of the year when algal blooms are not present and some areas do not experience regular summer algal blooms. The current approach of leaving warning signs in place throughout the year contributes to poor public perception of river health, and is not appropriate in terms of actual risk.

Management actions:

ARE2.4 Continue monitoring phytoplankton species and densities to inform public health notifications.

ARE2.5 Review algal bloom warning sign protocol and prepare a communication program to inform the community when harmful algal blooms occur.

ARE2.6 Develop a policy for use of recreational watercrafts in the Lower Vasse River, including consideration of public health constraints.

5.7 Culture and Heritage

5.7.1 Strategy CH1: Recognising Wadandi custodianship

Wadandi people have a strong connection to the Lower Vasse River and have considerable interest in its future management. This strategy will improve involvement of the Wadandi community in decisions and actions on river health and cultural connection.

Management actions:

CH1.6 In partnership with Wadandi people, include reference to traditional custodianship of the waterways and land in development of information resources.

CH1.7 Manage future access in a way that avoids additional disturbance and considers protection of potential sites of significance – however Wadandi activities such as fishing, camping, the gathering of bush foods and family recreational and educational activities, should not be restricted by implementation of this plan.

CH1.8 Seek to improve partnerships with the Wadandi community to increase their involvement in the management, protection and restoration of the Lower Vasse River.

CH1.9 Consult further with Wadandi representatives in regards to specific works which result from this plan.

CH1.10 Support programs that engage the Wadandi community in implementation of works associated with this plan.

5.7.2 Strategy CH2: Preserving historical values

Working towards the vision will improve community perception of the Lower Vasse River as an iconic and historical feature of the Busselton. The history of the river should be preserved in terms of physical structures and records of information.

Management actions:

CH2.3 Identify and ensure appropriate maintenance of sites of historical importance.

CH2.4 Develop interpretive material to increase understanding of local history, and to promote, appreciate and access historical sites.

5.8 Governance

5.8.1 Strategy G1: Collaborative and adaptive management

The City has coordinated the development of this WMP and has overall responsibility for implementation, but partnerships with other stakeholders will be essential to achieve many management actions and assess their outcomes. This strategy provides for a collaborative approach to management and will ensure outcomes of actions and new research inform future decisions. Roles and responsibilities of key stakeholders are defined in Table 4.

Management actions:

G1.2 The City to consider securing management orders over the waterway and adjacent public lands in Lower Vasse River study area, to facilitate implementation of this plan.

G1.5 Establish a Management Advisory Group comprised of representatives from the City, Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, Water Corporation of WA, GeoCatch, Wadandi representatives, and other community representatives.

G1.6 Continue water quality monitoring in the Lower Vasse River.

G1.7 Ensure adequate monitoring and reporting of outcomes from management actions, and feedback results into future management actions.

G1.8 Maintain and develop partnerships with research organisations to improve knowledge and management of the Lower Vasse River.

5.8.2 Strategy G2: Optimising planning tools

There is potential for the City to facilitate improved management through the planning and development framework. This strategy builds on the *Optimising Planning Tools* project, which outlines the potential use of planning tools in water quality protection.

Management actions:

G2.5 Improve clarity of planning approval requirements for changes to land use and new developments in the agricultural sector (e.g. horticulture, dairies, feedlots).

G2.6 Assess future development proposals and changes of land-use on adjoining lands with consideration of impacts on the Lower Vasse River.

G2.7 Include 50m wide foreshore reserves as part of future development adjacent to the river.

6 Implementation

6.1 Roles and responsibilities

The lead role of the City in the future management of the Lower Vasse River will be recognised through endorsement and adoption of this WMP. This will task the City with responsibility for coordinating implementation, however key stakeholders will have ongoing roles in many aspects of the WMP. These roles and responsibilities are defined in Table 5.

As captured in action G1.1 a Management Advisory Group is recommended to oversee implementation of this WMP, comprised of representatives from the City, Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, Water Corporation of WA, GeoCatch, Wadandi representatives and broader community representatives.

6.2 Management areas

In planning for implementation of management actions, it is helpful to define specific management areas of the catchment and river/foreshore, based on the characteristics of the areas and thus the actions that will be applicable. These are described as follows:

River and foreshore areas:

A. From the Butter Factory weir to Strelly Street, with significant areas of public reserve
B. From Strelly Street to Busselton Bypass, with adjacent residential and commercial areas and less prominent reserves
C. From Busselton Bypass to the Vasse Diversion, with adjacent rural properties

Catchment areas:

A. Busselton light industrial area
B. Other residential and commercial areas
C. Rural areas downstream of the Vasse Diversion
D. Rural catchment upstream of the Vasse Diversion

6.3 Implementation process

An adaptive process of action planning, works, evaluation and reporting is recommended for the WMP, summarised by Figure 22. The strategies and actions presented provide the basis for planning actions for a specified period of time, dependent on achievable priority works and research within available budgets. This would be a key role of the Management Advisory Group. Outcomes of these actions are measured through adequate monitoring, with results assessed in terms of progress towards the management objectives and vision. Reporting of outcomes to the community is essential to maintain community support and this forum would provide an opportunity to gain input to the next action planning cycle.

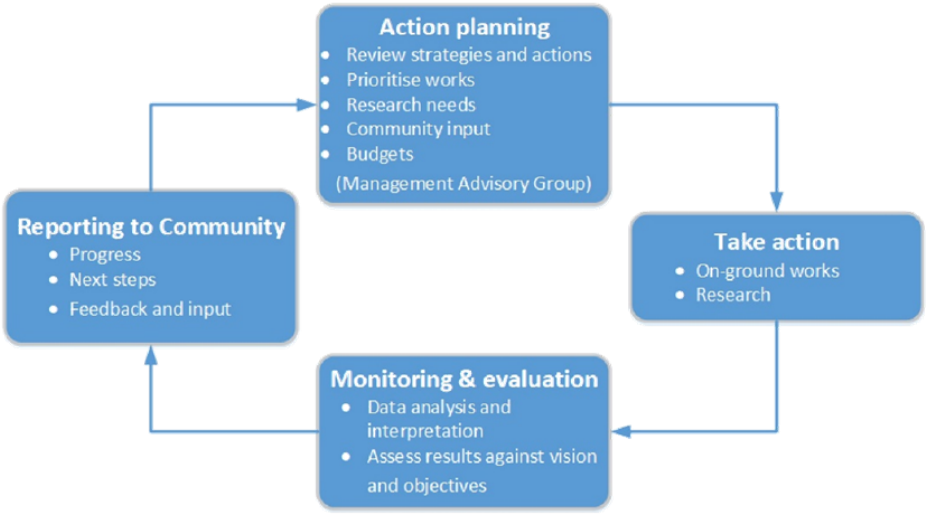

Figure 22. Implementation process for the Lower Vasse River Waterway Management Plan.

Table 4. Roles and responsibilities of key stakeholders for implementation of the Lower Vasse River Waterway Management Plan.

Stakeholder	Roles and Responsibilities
City	Overall implementation of the WMP. Management of reserves. Stormwater infrastructure upgrades and maintenance. Operation of the Vasse Diversion culvert. Operation of the Butter factory Weir boards. Support to community groups.
Department of Water and Environmental Regulation	Monitoring of water quality. Technical contributions to management decisions. Coordination of future investment in waterways management through Revitalising Geographe Waterways.
GeoCatch	Support to private landholders to improve land and waterway management in the catchment. Educational programs to minimise nutrient and sediment loads. Education, habitat restoration, and community group support for protection of Western Ringtail Possums.
Water Corporation	Managing flooding risk. Support to operational decisions for the Vasse Diversion culvert. Sewerage infrastructure development. Rural drainage maintenance, with potential to improve sediment trapping and nutrient assimilation.
Department of Biodiversity, Conservation and Attractions	Implement wildlife management and recovery plans. Community group support for protection of Western Ringtail Possums. Providing information about flora and fauna.
South West Boojarah Working Party	Advocating protection and enhancement of the Vasse River. Providing input to management decisions that affect environmental and cultural values. Engagement and participation of Aboriginal people in management decisions and actions.
Friends of reserves groups	Future role in local-level advocacy and management actions.

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8 Appendices

Appendix 1. List of vascular flora found within the Survey Area of the Lower Vasse River (Ecoedge 2017).

FAMILY	LATIN NAME	COMMON NAME	NATURALISED	PLANTED
Anacardiaceae	*Schinus terebinthifolius*	Pepper Tree	*	
Apiaceae	*Centella asiatica*	Centella		
Apocynaceae	*Vinca major*	Blue Periwinkle	*	
Araceae	*Zantedeschia aethiopica*	Arum Lily	*	
Asteraceae	*Lactuca saligna*	Wild Lettuce	*	
Asteraceae	*Sonchus asper*	Rough Sowthistle	*	
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak		
Cyperaceae	*Carex divisa*	Divided Sedge	*	
Cyperaceae	*Ficinia nodosa*	Knotted Club Rush		
Cyperaceae	*Gahnia trifida*	Coast Saw-sedge		
Cyperaceae	*Lepidosperma gladiatum*	Coast Sword-sedge		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		
Dilleniaceae	*Hibbertia cuneiformis*	Cutleaf Hibbertia		
Euphorbiaceae	*Euphorbia terracina*	Geraldton Carnation Weed	*	
Fabaceae	*Acacia saligna*	Orange Wattle		
Fabaceae	*Lupinus cosentinii*	Blue Lupin	*	
Fabaceae	*Vicia sativa*	Common Vetch	*	
Fabaceae	*Viminaria juncea*	Swishbush		
Goodeniaceae	*Dampiera alata*	Winged-stem Dampiera		
Haemodoraceae	*Anigozanthos flavidus*	Tall Kangaroo Paw		
Juncaceae	*Juncus kraussii*	Sea Rush		
Juncaceae	*Juncus pallidus*	Pale Rush		
Menyanthaceae	*Liparophyllum lasiospermum*			
Moraceae	*Ficus carica*	Common Fig	*	
Myrtaceae	*Agonis flexuosa*	Peppermint		
Myrtaceae	*Astartea scoparia*	Common Astartea		
Myrtaceae	*Calothamnus quadrifidus*	One-sided Bottlebrush		x

FAMILY	LATIN NAME	COMMON NAME	NATURALISED	PLANTED
Myrtaceae	*Corymbia calophylla*	Marri		
Myrtaceae	*Eucalyptus citriodora*	Lemon-scented Gum	*	x
Myrtaceae	*Eucalyptus rudis*	Flooded Gum		
Myrtaceae	*Kunzea glabrescens*	Spearwood		?
Myrtaceae	*Melaleuca cuticularis*	Saltwater Paperbark		
Myrtaceae	*Melaleuca huegelii*	Chenille Honeymyrtle		x
Myrtaceae	*Melaleuca rhaphiophylla*	Swamp Paperbark		
Myrtaceae	*Melaleuca viminea*	Mohan		
Myrtaceae	*Taxandria parviceps*			
Papaveraceae	*Fumaria muralis*	Wall Fumitory	*	
Poaceae	*Bromus diandrus*	Great Brome	*	
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass	*	
Poaceae	*Cortaderia selloana*	Pampas Grass	*	
Poaceae	*Cynodon dactylon*	Couch	*	
Poaceae	*Ehrharta calycina*	Perennial Veldt Grass	*	
Poaceae	*Ehrharta longiflora*	Annual Veldt Grass	*	
Poaceae	*Holcus lanatus*	Yorkshire Fog	*	
Poaceae	*Phleum pratense*	Timothy	*	
Polygonaceae	*Persicaria hydropiper*	Water Pepper		
Polygonaceae	*Rumex conglomeratus*	Clustered Dock	*	
Proteaceae	*Banksia grandis*	Bull Banksia		
Proteaceae	*Banksia littoralis*	Swamp Banksia		
Salicaceae	*Salix babylonica*	Weeping Willow	*	
Solonaceae	*Solanum linnaeanum*	Apple of Sodom	*	
Typhaceae	*Typha orientalis*	Typha		

Appendix 2. Summary of Water Sensitive Urban Design infrastructure

WSUD infrastructure implemented in the Lower Vasse River Catchment

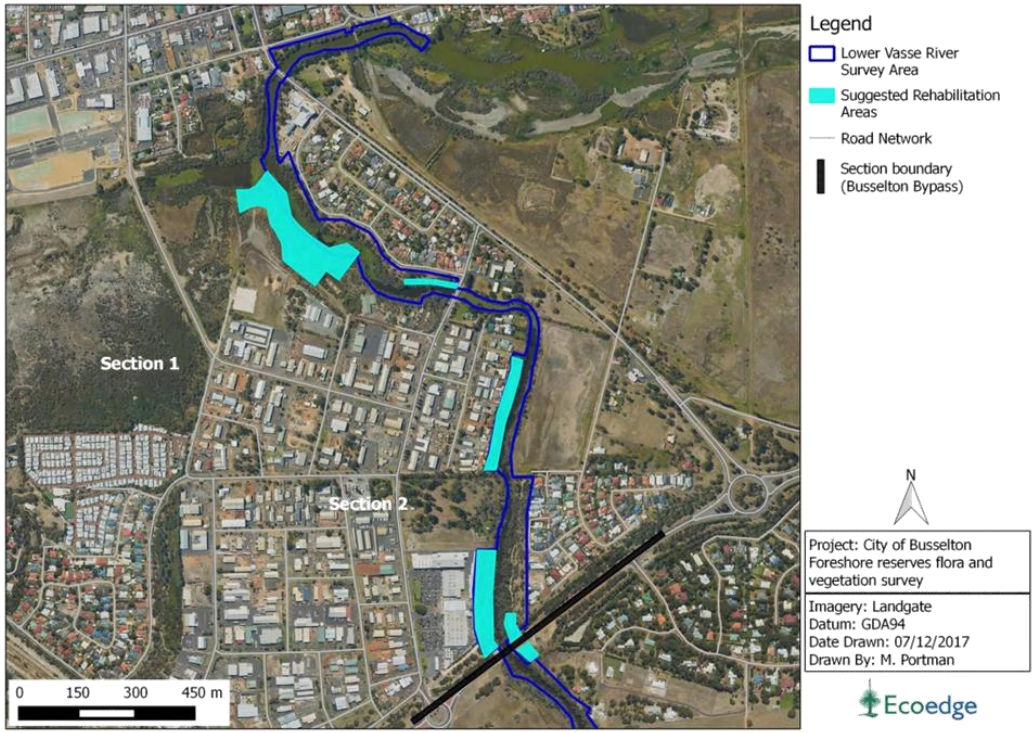
Description
CBD area
Kent Street streetscaping Kent Street biofiltration bed
Coles Carpark Bio-filtration Gardens
Woolworths carpark – Rain Gardens and soak wells
Queen Street/Prince Street Bio-filtration beds
Busselton Community Resource Centre Rain Gardens
Busselton Community Youth Centre Rain gardens– High and Jolliffe Street Busselton
Queen Street Outfall – Natural wetlands
Busselton LIA
Frederick Street – Artificial ponds and vegetated swales
College Avenue – Constructed wetland
College – Cook connector drain
Bunnings Carpark – detention ponds
Fairlawn road – Vegetated Swale
Strelly Street – Demonstration – Biofiltration swales and rain gardens Urban Drainage Pilot Project - Details on Strelly Street biofiltration swales
Community Garden – Vegetated swales and detention ponds
Bunbury Street/Roe Terrace – Vegetated detention pond and constructed wetland
Roe Terrace – Vegetated Swale
Bunbury/Barlee Street – Bio-filtration basin

Locations of WSUD in Busselton CBD:

Locations of WSUD in Busselton LIA:

Appendix 3. Recommended revegetation areas for the Lower Vasse River Study area

Recommended rehabilitation areas identified the 2017 vegetation survey (Ecoedge 2017). Note the western foreshore area to the south was revegetated in June 2018.



Appendix 4. Suggested species for revegetation of the Lower Vasse River

Revegetation species list for damp and terrestrial areas (Ecoedge 2017).

Family	Species	Common Name	Habitat	Form
Cyperaceae	*Ficinia nodosa*	Knotted Club Rush	Damp	Rush
Cyperaceae	*Gahnia trifida*	Coast Saw-sedge	Damp	Sedge
Cyperaceae	*Lepidosperma gladiatum*	Coast Sword-sedge	Damp	Sedge
Cyperaceae	*Lepidosperma squamatum*		Dry	Sedge
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	Dry	Herb
Dilleniaceae	*Hibbertia cuneiformis*	Cutleaf Hibbertia	Dry	Shrub
Dilleniaceae	*Hibbertia diamesogenos*		Dry	Shrub
Ericaceae	*Astroloma ciliatum*	Candle Cranberry	Dry	Shrub
Fabaceae	*Acacia saligna*	Orange Wattle	Damp	Shrub
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria	Dry	Climber
Fabaceae	*Jacksonia gracillima*		Dry	Shrub
Fabaceae	*Viminaria juncea*	Swishbush	Damp	Shrub
Goodeniaceae	*Dampiera alata*	Winged-stem Dampiera	Damp	Shrub
Haemodoraceae	*Anigozanthos flavidus*	Tall Kangaroo Paw	Dry	Herb
Hemerocallidaceae	*Agrostocrinum scabrum*	Blue Grass Lily	Dry	Herb
Juncaceae	*Juncus kraussii*	Sea Rush	Damp	Rush
Juncaceae	*Juncus pallidus*	Pale Rush	Damp	Rush
Myrtaceae	*Agonis flexuosa*	Peppermint	Dry	Tree
Myrtaceae	*Astartea scoparia*	Common Astartea	Damp	Shrub
Myrtaceae	*Calothamnus sanguineus*	Silky-leaved Blood flower	Dry	Shrub
Myrtaceae	*Eucalyptus rudis*	Flooded Gum	Damp	Tree
Myrtaceae	*Hypocalymma angustifolium*	White Myrtle	Damp	Shrub
Myrtaceae	*Kunzea glabrescens*	Spearwood	Dry	Shrub
Myrtaceae	*Melaleuca cuticularis*	Saltwater Paperbark	Damp/ Saline	Tree
Poaceae	*Austrostipa flavescens*		Dry	Herb
Proteaceae	*Conospermum caeruleum* ssp. *marginatum*	Blue Brother	Dry	Shrub
Proteaceae	*Xylomelum occidentale*	Woody Pear	Dry	Tree
Santalaceae	*Exocarpos odoratus*	Scented Ballart	Damp	Shrub
Thymelaeaceae	*Pimelea angustifolia*	Narrow-leaved Pimelea	Dry	Shrub

List of emergent and submerged species for restoration of seasonally and permanently inundated areas (littoral zone).

Species	Common Name	Habitat	Form
Centella asiatica	Native celery, Gotu-cola	seasonally emergent	groundcover
Cotula coron			
Melaleuca raphiophylla	Swamp paperbark	seasonally emergent	tree
Eleocharis acuta	Common spike-rush	seasonally-permanent emergent	Rush
Schoenoplectus vallidus		seasonally-permanent emergent	rush
Baumea articulata	Jointed twigrush	seasonally-permanent emergent	rush
Baumea juncea		seasonally emergent	rush
Baumea rubiginosa		seasonally emergent	
Liparophyllum sp		seasonally emergent	broad leaf
Cycnogeton huegelii	Water ribbons	submerged – seasonally emergent aquatic	narrow leaves
Cycnogeton procera	Water ribbons	submerged aquatic	narrow leaves
Potamogeton crispus	Curly pondweed	submerged aquatic	branched macrophyte
Potamogeton ochreatus		submerged aquatic	branched macrophyte
Potamogeton drummondii		submerged aquatic	submerged and floating leaves
Ottelia ovalifoloa	Swamp lily	submerged aquatic	submerged and floating leaves
Stuckenia pectinatus		submerged aquatic	branched macrophyte

Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**
GOVERNMENT OF WESTERN AUSTRALIA

Toby Inlet
Waterway Management Plan
May 2019

City of Busselton
Geographe Bay

Revitalising Geographe Waterways
VASSE taskFORCE

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Acknowledgement of Nyungar people and country

The Wadandi Nyungar people are acknowledged as the traditional custodians of Toby Inlet and its catchment. Toby Inlet is a significant place of camping, fishing, hunting, and gathering food. Waterways are fundamental to life and wellbeing, and Aboriginal custodians have a spiritual connection that tasks them with the responsibility to look after these important environments.

Executive Summary

Background

Toby Inlet is a small estuary near the town of Dunsborough, Western Australia, about 250 km South of Perth. It is narrow and elongated, extending parallel to the coastline of Geographe Bay for approximately 6 km. Catchment development and hydrological changes have led to water quality and sedimentation problems in Toby Inlet. Remnant vegetation in adjacent areas is threatened by weed invasion, disturbance and illegal clearing. Despite these problems, Toby Inlet, and associated wetlands and remnant fringing vegetation retain natural values, which contribute to the amenity of the area and enjoyment by the local community.

This Waterway Management Plan (WMP) was initiated though the Revitalising Geographe Waterways program, in response to community concerns about water quality issues in key water assets in the Geographe Bay Catchment. The community have long been involved in management of Toby Inlet and its catchment, largely through the efforts of the Toby Inlet Catchment (TIC) Group to undertake research, management planning and on-ground works throughout the catchment. However there is a need for greater clarity in management roles and for a lead organisation to support community initiatives.

The WMP was developed using a collaborative approach that has allowed for extensive consultation to inform future management of Toby Inlet that aligns with community priorities, is well-understood and accepted, and has commitment to implementation by stakeholders.

Purpose and scope

The City of Busselton (the City) has developed this WMP to provide future management actions that will work towards realising the vision for Toby Inlet:

> *A healthy waterway and fringing vegetation that is actively managed, protected, valued and enjoyed by the community.*

The study area for the WMP includes the main waters of Toby Inlet, adjacent public reserves and wetland areas upstream to Quindalup Siding Road. The WMP includes a description of the characteristics and management issues for Toby Inlet, and provides objectives for future management. Through a review of available management options and consideration of stakeholder input, a comprehensive series of management strategies, each with specific actions, has been developed to guide works that will contribute to the objectives and overall vision for Toby Inlet.

Management focus areas

Management issues for Toby Inlet have been grouped into nine focus areas, with sixteen associated management objectives. These are summarised here in order of importance as rated during community consultation. The strategies and associated actions are provided in the table below, with the expected outcomes for each focus area. Owing to the interconnected nature of the system, many management strategies contribute to more than one objective.

1. Sedimentation

Extensive sediment deposition is evident in much of Toby Inlet, with deposits in the upper reach seasonally exposed during low water levels. This is a high priority management issue, which results in poor amenity associated loss of open water vistas and unpleasant odours during low water levels. Sediment deposition also interferes with water flow, fish movement and recreational use.

Objectives:

- Reduce catchment sediments and contaminants from existing and new developments entering Toby Inlet.
- Manage existing sediment to improve water quality, water flow and amenity of Toby Inlet.

2. Amenity

The issue of amenity in Toby Inlet is directly related to sedimentation, water quality and ecology. Amenity is also linked to recreation and access, which provide opportunities to enjoy Toby Inlet.

Objective:

- Improve visual amenity, public health and odours so that residents and visitors alike can enjoy Toby Inlet.

3. Water flow

Water flow within Toby Inlet has been significantly altered through drainage and diversion since European settlement. Reduced catchment flows are considered to have two main consequences: reduced winter flushing, contributing to poor water quality and sedimentation; and less frequent connection to the ocean, reducing summer flushing and increasing winter flood risk.

Objective:

- Optimise all water flow in Toby Inlet to balance improvement of water quality, protection of ecological values and public amenity, while maintaining flood protection.

4. Water quality

Water quality in Toby Inlet, associated wetlands and catchment tributaries has declined due to increased loads of sediments and nutrients, and poor flushing. Elevated nutrient levels typically cause increased growth of algae, including microscopic algae (phytoplankton) and filamentous algae (macroalgae), which impact amenity and can pose a public health risk. Macroalgal blooms in particular have been problematic. They are unsightly and can cover large areas of water, restricting access, and support breeding of nuisance midges. Decomposition of the algae reduces oxygen levels in the water and contributes to accumulation of sulfidic organic sediments.

Objectives:

- Reduce and manage nutrients and other pollutants entering Toby Inlet to improve water quality and lessen the frequency and severity of algal blooms.
- Minimise any additional nutrients entering Toby Inlet from new developments and agricultural intensification.

5. Toby Inlet Ocean Exchange

The status of Toby Inlet's connection to the ocean directly affects water quality and water levels. When the sand bar at the mouth of the inlet is closed during summer, water quality is poor and conducive to algal growth. When the sand bar is open, tidal flushing dilutes the nutrient concentrations and

reduces residence time, limiting algal growth. When the sand bar is closed during winter, water levels in Toby Inlet can become high enough to cause localised flooding problems. Declining water quality has likely increased the demand for the Inlet to be opened, and this will be an important ongoing component of managing Toby Inlet.

Objective:

- Actively manage the Toby Inlet mouth to maximise ecology, water quality and recreational values.

6. Ecology

Toby Inlet and associated wetland area retains many important ecological attributes, which contribute to regional biodiversity and are valued highly by the local community. Remnant vegetation in the study area has natural value, provides important habitat and supports ecological functions. Key threats to vegetation are weed invasion, unauthorised clearing within public reserves and unmanaged access. The aquatic habitats of these systems are closely linked to the fringing vegetation and support diverse populations of aquatic fauna and waterbirds.

Objectives:

- Restore, maintain and protect the ecological values of Toby Inlet.
- Reduce the impacts of threatening processes on the ecological values of Toby Inlet.

7. Recreation and Education

Toby Inlet provides significant recreational opportunities, including fishing, swimming, paddling, birdwatching, exercising and passive enjoyment; and also opportunities for people to learn about the ecology and history of the area. Poor water quality and sedimentation issues restrict access for recreation within the water, and poor visual amenity and odours affect other activities. Unmanaged access has degraded fringing vegetation and caused some bank erosion. There is significant potential for improving recreational and educational opportunities in and around Toby Inlet.

Objectives:

- Improve and manage public access for recreational purposes that support the amenity and ecological values of Toby Inlet.
- Facilitate appropriate water based recreational activities with consideration to the ecological values and water quality of Toby Inlet.
- Raise community awareness of Toby Inlet's recreational, cultural and ecological values.

8. Heritage

Toby Inlet holds significant cultural value for the Wadandi people due to the abundance of resources and the natural protection from weather conditions. The area has been important for hunting and camping for many years both pre- and post-settlement. Aboriginal people are well aware of the decline in health of the inlet and the relationship to drainage changes and land development. A key issue raised by Aboriginal representatives was minimising additional access and infrastructure for recreation, while retaining access for Aboriginal people.

The area around Toby Inlet was an important part of early European colonisation. Quindalup was the primary settlement established in 1866, with a school, supporting local timber export. There is also a history connected to whaling.

Objective:

- Understand, protect and preserve the heritage values of Toby Inlet.

9. Governance

An independent review of waterway management highlighted the need for Toby Inlet to have a designated manager, and for greater clarity of management roles for various organisations. The Toby Inlet Catchment Group has been instrumental in past management, but implementation of an existing management plan has been limited by a lack of funding and support from relevant organisations.

The review also recommended that research and monitoring need to be a component of future management. This would facilitate ongoing assessment and reporting of progress and allow for adaptive management based on outcomes and new knowledge.

Objectives:

- Develop and maintain partnerships and a collaborative approach between stakeholders and the community when managing Toby Inlet.
- Involve the community in the future management of Toby Inlet.
- Adopt evidence based decision making in the long term management of Toby Inlet.

Implementation

The lead role of the City in the future management of Toby Inlet will be recognised through endorsement and adoption of this Waterway Management Plan. Other key stakeholders will continue to have important roles in many aspects of implementation, and there is an ongoing need for community reporting and feedback. A framework for implementation is provided that defines roles and responsibilities for management and an adaptive cycle for management.

Implementation process for the Toby Inlet Waterway Management Plan:

Management Strategies and Actions for Toby Inlet and expected outcomes for each focus area

Focus areas: Water Quality (WQ); Toby Inlet Ocean Exchange (TIOE); Ecology (E); Water Flow (WF); Sediments (S); Amenity; Recreation and Education (ARE); Culture and Heritage (CH); Governance (G).

Management Strategy	Management Actions	Expected outcomes (related focus area)
Optimal management of Toby Inlet ocean exchange	• Maintain Toby Inlet ocean outlet, the Station Gully culvert and the Station Gully outlet in accordance with the Operational Procedures (Appendix 2). • Monitor the status of the outlet through a telemetered system to determine when opening of the sand bar is necessary. • Ensure the culvert between Station Gully and Toby Inlet remains open to improve water quality in the upper reach of Toby Inlet, east of the ocean outlet.	Sand bar management (TIOE) Defined management (G) Reduced algal growth (WQ, A) Less sediment exposure (S, A) Improved amenity (A, RE) Enhanced fish movement (E, RE) Optimising Water flow (WF)
Investigate sediment removal	• Define priority areas for sediment management and determine sediment composition and volume for these areas, building on previous sediment investigations. • Assess potential outcomes and impacts of sediment removal from priority areas and undertake a cost/benefit analysis of strategic sediment removal. • Assess whether sediment agitation would facilitate mobilisation and flushing of sediment deposits on Toby Inlet.	Evidence-based decision-making (G) Less sediment exposure (S, A) Improved amenity (A, RE) Manage existing sediment (S) Optimising Water flow (WF)
Prevent further sedimentation	• Improve understanding of sediment sources and transport through water quality monitoring. • Develop an education approach to reducing sediments inputs from the catchment. • Identify and ensure management of potential erosion problems from new developments and changes in land use during the planning process, through implementing the Better Urban Water Management framework. • Investigate key sediment sources in the catchment and potential for works to stabilise drains and increase sediment trapping within the drainage network.	Reduce catchment sediments (WQ, S) Minimise development impacts (S, G) Evidence-based decision-making (G)
Rehabilitate exposed sediment deposits	• Identify areas of exposed sediments that could be revegetated to improve habitat and amenity and stabilise sediments. • Undertake trial revegetation of samphire in exposed sediment.	Creation of new habitat (E) Covering unsightly sediment deposits (S, A)
Reducing nutrient sources from the catchment	• Completion of scheduled infill sewerage works in residential areas adjacent to Toby Inlet. • Review the sewerage works once completed, and address any lack of connection to sewerage infrastructure through education campaigns or incentives if deemed necessary. • Ensure Geographe Bay catchment management initiatives extend to the Catchment of Toby Inlet, including: implementation of best management practices; and community education to reduce inputs from gardening and livestock activities in urban and special rural areas.	Reduce inputs of nutrients and other pollutants (WQ) Reduce catchment sediments (S) Reduced algal growth (WQ, A) Minimise development impacts (WQ, G)

	• Increase potential for nutrient assimilation in the rural drainage network in conjunction with sediment trapping and through restoration. • Identify opportunities for reducing nutrient, sediment and pollutant sources through upgrades to stormwater infrastructure. • Continue current water quality monitoring within Toby Inlet, and extend routine monitoring to include associated wetlands and catchment tributaries, to ensure information requirements for prioritising and reviewing management initiatives are met. • Support educational campaigns that aim to reduce nutrients in runoff through individual and community actions (e.g. Bay OK) and investigate options to improve nutrient management in public open space. • Minimise future nutrient sources from new development and land use change at the planning stage through implementing the *Better Urban Water Management* framework. • Support implementation of the Vasse Wonnerup wetlands Geographe Bay Water Quality Improvement Plan.	Evidence-based decision-making (G)
Effectively manage foreshore reserves	• Prepare and implement a prioritised works program for weed control and revegetation. • Support community efforts in weed control and revegetation. • Ensure revegetation in high amenity areas is appealing and maintains vistas to increase community support for these activities. • Effectively manage recreational access to protect and enhance the key values of reserve areas. • Create awareness of reserve boundaries through bollards and signage where appropriate. • Develop information resources for landholders to raise awareness of reserve boundaries, the importance of fringing vegetation, weed problems and the restrictions on clearing native vegetation and building jetty structures. • Assess foreshore reserve areas that have no public access and develop appropriate management actions to benefit the broader public. • Develop a policy for jetties that ensures structural integrity and protection of adjacent foreshore areas and prevents establishment of new structures.	Conservation of vegetated habitat (E) Reduce threatening processes (E) Improved amenity (A) Managing access (RE) Maintaining fringing vegetation buffer (WQ) Preventing bank erosion (S)
Understanding fauna	• Support further research on aquatic and terrestrial fauna and bird populations to inform management initiatives and assess outcomes. • Pursue a community science approach to collecting bird data. • Develop information resources to increase community interest and understanding of fauna.	Awareness and understanding of ecological values (RE) Community involvement in management (G) Evidence-based decision-making (G)
Improving facilities for community appreciation	• Seek community input on the *Access Management Plan* for Toby Inlet (SW Environmental 2018), and subsequently develop and implement appropriate access-ways and recreational infrastructure. • Determine requirements for additional parking in support of improved facilities.	Improved public access and amenity (RE) Support for appropriate activities (RE)

	• Enhance bird habitat in connection with existing and potential bird watching sites. • Encourage bird watchers to join a community science approach to collecting bird data. • Support schools in using Toby Inlet as an outdoor learning environment, including provision of information resources and consideration of an outdoor classroom.	Awareness and understanding of ecological values (RE) Community involvement in management (G)
Providing informative resources	• Develop appropriate signage in connection with improved access and facilities to inform the community about: ecological values of Toby Inlet; location and use of access and facilities; cultural and historical values; and management initiatives underway. • Prepare and distribute fact sheets and educational material for key management focus areas, relevant to schools, community members and natural resource managers. • Continue to update the Revitalising Geographe Waterways website with information on Toby Inlet and its management.	Awareness of recreational, cultural and ecological values (RE)
Recognising Aboriginal custodianship	• In partnership with local Aboriginal people, include reference to traditional custodianship of the waterways and land in development of information resources. • Manage future access in a way that avoids additional disturbance and considers protection of potential sites of Aboriginal significance – however activities of local Aboriginal people, such as fishing, camping, the gathering of bush foods and family recreational and educational activities, will not be restricted by implementation of this plan. • Seek to improve partnerships with the Nyungar community to increase their involvement in the management, protection and restoration of Toby Inlet and the study area. • Consult further with Aboriginal representatives in regard to specific works which result from this plan. • Support programs that engage the Aboriginal community in implementation of works associated with this plan.	Understanding and protecting heritage values (CH) Community involvement in management (G)
Conserve historical values	• Identify and ensure appropriate maintenance of sites historical importance. • Develop interpretive material to increase understanding of local history, and to promote, appreciate and access historical sites.	Understanding and protecting heritage values (CH)
Defined and collaborative management	• City to consider securing management order over waterways and adjacent public lands in study areas, to facilitate implementation. • Establish a Management Advisory Committee comprised of representatives from the City, Toby Inlet Catchment Group, Department of Water and Environmental Regulation, Water Corporation, GeoCatch, South West Catchments Council, Wadandi representatives and broader community representatives. • Support the Toby Inlet Catchment Group as active participants in planning, on-ground works, and as a key link to the community.	Collaborative approach to management (G) Community involvement in management (G)

	• Facilitate the development of locally-active Friends of Toby Inlet groups to advocate and coordinate on-ground work in reserves and on private property. • Define and resolve issues around vesting of Unallocated Crown Land.	
Evaluate and adapt management actions	• Continue monitoring of water quality in Toby Inlet. • Review monitoring requirements for catchment tributaries and groundwater. • Undertake assessment of macroalgal growth. • Ensure timely reporting of monitoring and research outcomes to the management advisory group. • Review future management actions in light of monitoring and research outcomes.	Evidence-based decision-making (G)

1 Introduction

The City of Busselton (the City) has developed this Waterway Management Plan (WMP) to guide future management actions that will lead to improved water quality and ecological health for the Toby Inlet and associated reserves and wetlands within the study area. The vision for Toby Inlet, developed in partnership with the community and stakeholders, is:

> *A healthy waterway and fringing vegetation that is actively managed, protected, valued and enjoyed by the community".*

1.1 Background to this Waterway Management Plan

Catchment development and hydrological changes have led to water quality and sedimentation issues in Toby Inlet for many years. Nutrient enrichment has resulted in seasonal blooms of filamentous algae (macroalgae), which reduce amenity and recreation values by blocking open waters and causing foul odours when they decompose. Sediment deposition in the Inlet has created shallower conditions which are exposed at low water levels, reducing visual amenity and contributing to odour problems. Phytoplankton blooms and stranding of fish in shallow pools have occasionally resulted in fish deaths in the Inlet.

This WMP is part of Revitalising Geographe Waterways (RGW), a $15 million program developed to improve water quality and ecosystem health in key water assets. Within the RGW program, the City has been identified as the lead agency for progressing improved waterway management within the Lower Vasse River and the Toby Inlet, and was given responsibility to prepare Waterway Management Plans for these systems. The Department of Biodiversity, Conservation and Attractions was given responsibility to develop an Operational Plan for the Vasse-Wonnerup Wetland Systems.

The RGW program is one of five focus areas of the Vasse Geographe Strategy, a State Government initiative to address water quality in the Geographe Bay catchment (Figure 1). The program also includes two projects directly related to the Toby Inlet WMP: the Reconnecting Toby Inlet hydrological modelling project; and the infill sewage project for residential areas adjacent to Toby Inlet.

The Vasse Geographe Strategy was initiated by an independent review of waterways management (Hart 2014), commissioned by the State Government in response to serious community concerns about water quality issues. The Vasse Geographe Strategy is overseen by the Vasse Taskforce, comprising representatives from:

- Department of Water and Environmental Regulation (DWER)
- City of Busselton (the City)
- Shire of Capel
- Geographe catchment Council (GeoCatch)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Primary Industries and Regional Development (DPIRD)
- Department of Planning, Land and Heritage (DPLH)
- South West Catchments Council (SWCC)
- Water Corporation (WCorp)
- Busselton Water (BW)

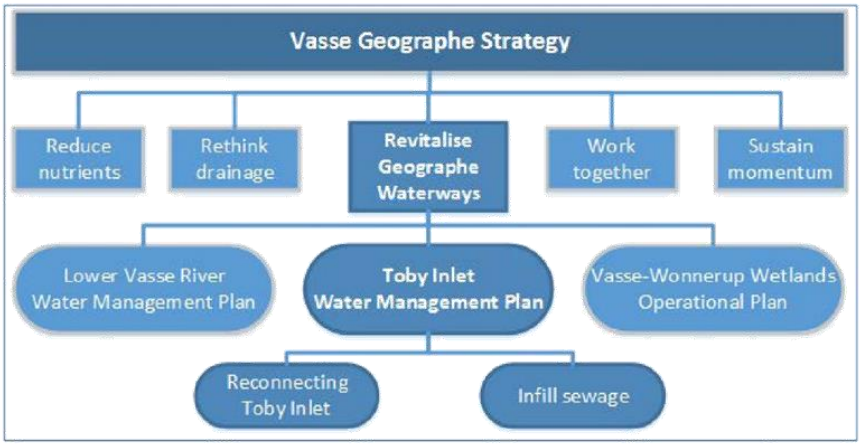

Figure 1. Management framework for the Toby Inlet Waterway Management Plan.

1.2 Study Area Description

Toby Inlet is a small estuary near the town of Dunsborough, Western Australia, about 250 km South of Perth (Figure 2). It is narrow and elongated, extending parallel to the coastline of Geographe Bay for approximately 6 km. It is situated on the Swan Coastal Plain and is connected to seasonal wetland areas upstream. The study area for the WMP is 118 hectares, encompassing Toby Inlet itself, adjacent public reserves, and the wetland area extending upstream approximately 2.7 km from Caves Road to Quindalup Siding Road. Quindalup Siding Road acts as a physical barrier to other wetlands to the east. The study area also includes a short reach of Station Gully Drain between Caves Road and the beach (150 m), which dissects the easternmost section of Toby Inlet (500 m) commonly referred to as the Deadwater. Station Gully Drain is openly connected to the Deadwater, but is only connected to Toby Inlet via a culvert under the access road to the beach.

1.2.1 Landscape and hydrology

Toby Inlet has a catchment area of approximately 33 km^2 including large areas of Swan Coastal Plain, and bounded by the Whicher Scarp to the south. The portion on the coastal plain areas is characterised by deep sandy soils and seasonally inundated flats, which have been subject to extensive clearing and drainage for agriculture. Only around 30% of native vegetation remains in the Toby Inlet catchment, with key remnants occurring in foreshore reserves, on private land adjacent to the wetland areas, and on reserves and private land in the upper catchment.

Artificial drainage, undertaken for much of the Swan Coastal Plain in the early 1900s to improve agricultural value, has changed the hydrology of Toby inlet and its catchment. This included drainage and redirection of flow within wetland areas to the south of Toby Inlet, and diversion of the upper reaches of Station Gully, Annie Brook and Mary Brook into a single drain into Geographe Bay at the eastern end of Toby Inlet (Station Gully Drain). These changes have effectively reduced the original catchment area of the inlet and the volume of water conveyed. The average annual rainfall in the

catchment is 651mm (10-year average, BoM 2018), with declining rainfall evident over the last 20 years (Figure 3).

Toby Inlet is intermittently connected to the ocean, either naturally or artificially, at two points: via a channel to the east of Station Gully; and via a culvert to Station Gully, which then flows to the ocean. The connection of Toby Inlet to the ocean is likely to have always been intermittent, but it is thought that reduced flows from the catchment have decreased natural breaching of the sand bar.

Figure 2. Toby Inlet locality and study area, and routine monitoring sites.

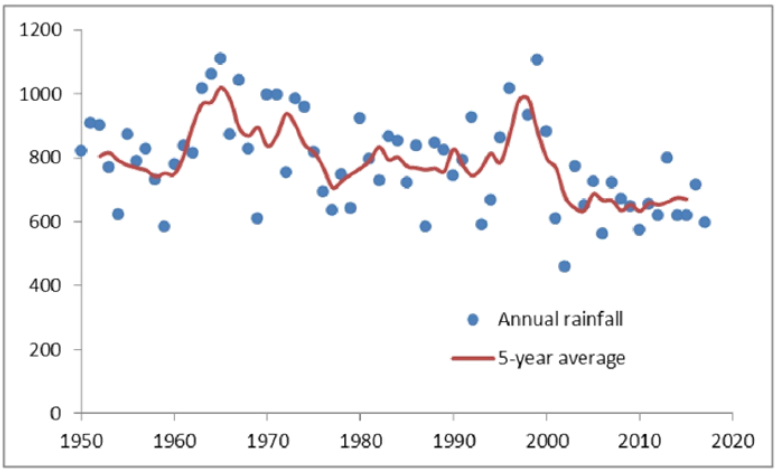

Figure 3. Rainfall records for Cape Naturaliste (BoM 2018). The 5-year average for each year includes two years before and after.

1.2.2 Land use and tenure

From the mouth of the Inlet to 300m upstream of Caves Rd, the study area is entirely within publicly-owned land (Figure 4). Upstream from this point the wetland areas are privately owned, with the exception of a drainage reserve in the central section approximately 800m long and 20m wide (Responsible agency DWER). Public lands include reserves vested in the City, unallocated Crown land (UCL) and road reserves (Appendix 1).

The eastern 1.5km section of Toby Inlet is entirely within public reserve between Caves Road and Geographe Bay, and is managed by the City. West of this, the Inlet is surrounded by residential development. Despite the foreshore being entirely public land, many sections are inaccessible to the public and are managed by adjacent private landholders. Clearing of foreshore vegetation, weed invasion, lawn encroachment and dumping of garden refuse are common problems in these areas. Many residents have established private jetties, which vary in quality and at times debris from these structures floats into the Inlet. Upstream of Caves Road, land use is mainly rural.

Agriculture (50%) and rural residential areas (32%) are the dominant land uses in the catchment. The remaining area consist of existing and future urban development (8%: residential, business and industrial), and reserves and public open space (10%). There is currently considerable urban residential development occurring on coastal plain areas to the south west of Toby Inlet.

Figure 4. Toby Inlet study area land tenure.

1.2.3 Natural and social values

Toby Inlet study area retains high natural values that are important for conservation purposes, and contribute to the amenity of the area and enjoyment by the local community. The Inlet itself provides habitat for fish, crabs, frogs and aquatic macroinvertebrates that support food webs. The surrounding reserves include important areas of intact remnant vegetation, including areas of the Threatened[1] Coastal Saltmarsh ecological community. Foreshore vegetation and open waters support many species of waterbirds. Remnant vegetation throughout the study area provides habitat for other birds and terrestrial fauna including the Critically Endangered[2] Western Ringtail Possum (*Pseudocheirus occidentalis*) and the Priority 4 Quenda[3] (*Isoodon obesulus fusciventer*, also known as the Southern Brown Bandicoot).

Residential areas adjacent to Toby Inlet in Quindalup benefit from its quiet location away from central Dunsborough and the natural amenity of its proximity to the protected waters of Toby inlet and Geographe Bay. The remnant vegetation, water vistas, birdlife and fishing opportunities are enjoyed by the local community and visitors to the area.

[1] *Environmental Protection and Biodiversity Conservation Act* 1999 (Commonwealth) (EPBC Act)
[2] Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WA); (EPBC Act)
[3] Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WA)

1.3 History of Management

It is important to acknowledge past and ongoing work of the community-based Toby Inlet Catchment (TIC) Group in advocating and undertaking active management of Toby Inlet, associated wetlands and broader catchment. In 1996-97, the TIC Group initiated surveys on vegetation (Weston 1997), terrestrial fauna (HAS 1997), birds (Clay and Clay 1996), and water quality and aquatic macroinvertebrates (Streamtec 1997). The outcomes of this work highlighted degradation of terrestrial and aquatic habitats in the Inlet and its catchment. Data from these surveys was used to prepare the *Toby Inlet and Associated Wetlands Management Plan* (Comer and Clay 1999) for the TIC Group. TIC Group has also prepared the *Toby Inlet Catchment Management Plan* (Clay 2002) to direct catchment scale works to improve water quality and manage flora and fauna.

The Toby Inlet Steering Committee was formed in 2003, which included community members from TIC Group, Dunsborough Coast and Land Care, Sussex LCDC and the Quindalup Strip Preservation Committee; councillors and an officer from the (then) Shire of Busselton; and officers from GeoCatch and the Water Corporation. The TIC Group prepared the *Management Plan for the Toby Inlet Foreshore and Waters* (Clay 2005), supported by the Steering Committee and adopted by the (then) Shire of Busselton.

The issues, objectives and actions in the 2005 management plan remain relevant. Since the adoption of the 2005 management plan, further work has been done to monitor water quality; determine needs and outcomes of opening the sand bar; understand sediment characteristics in the inlet; and to assess and improve the health of foreshore vegetation.

1.4 Process for developing the Waterway Management Plan

The WMP has been developed using a collaborative approach that has allowed for extensive consultation to work towards future management of Toby Inlet that aligns with community priorities, is well-understood and accepted, and has commitment to implementation by stakeholders. Key stakeholders that have contributed to this WMP are:

- City
- Community members
- Aboriginal people
- Toby Inlet Catchment Group
- Dunsborough Coast and Land Care
- GeoCatch
- Department of Water and Environmental Regulation
- Water Corporation

The process for developing the WMP is shown in Figure 5. The consultation process has contributed directly to identifying and developing the management issues, vision, management objectives, management strategies and actions for the WMP. Activities undertaken for consultation are outlined in the following sections. The consultation process and the overall WMP have been informed by review of existing information about Toby Inlet and by new information gained through projects undertaken during the planning process. It is important to note the adaptive nature of this WMP. It

has been prepared at a point in time, using the information currently available. Implementation will require an ongoing process of monitoring and evaluation to guide future actions.

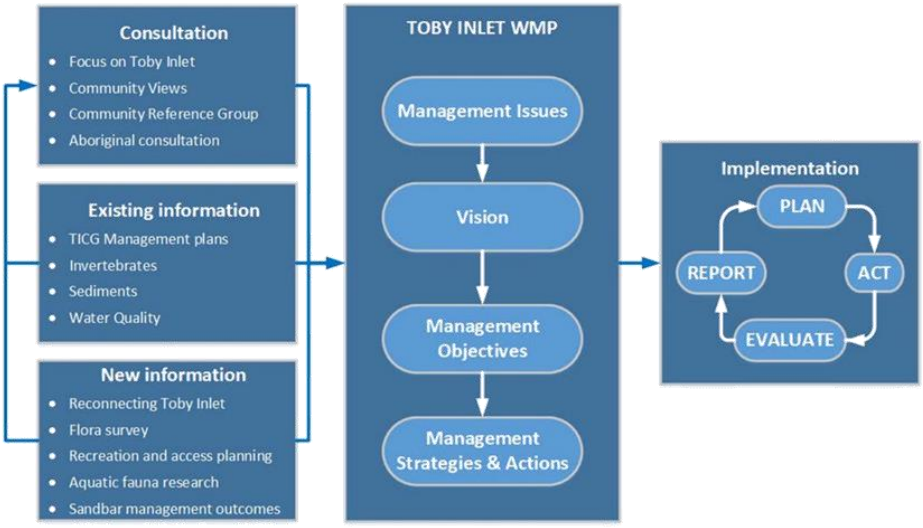

Figure 5. Process for developing the Waterway Management Plan for Toby Inlet.

1.4.1 Community consultation

Consultation with stakeholders was an integral part of preparing this WMP. The aims of consultation were:

- To understand community issues and concerns about Toby Inlet;
- Gain input, ideas, feedback into future management of the Toby Inlet;
- To get support from the community on proposed actions; and
- To raise community awareness and understanding of local water quality issues.

Early consultation events were widely advertised to attract a broad representation from the community. The first of these, *Focus on Toby Inlet* in June 2015, provided information on current understanding of Toby Inlet and sought to identify issues of most importance to the community. The *Community Views* event in March 2016 was also open to whole community and facilitated rating of management issues, valued characteristics and desired change (Figure 6; AHA 2016). These results reflected a high level of importance on issues related to the health of Toby Inlet and associated amenity (82%). Other issues rated as important were recreation and access, heritage, flood and management. The outcomes of this consultation were used to formally identify key management issues, as outlined in Section 2 of the WMP. Information provided by the community and suggested management actions were used to develop draft management objectives, and were considered when reviewing management options.

Following initial consultation, a Community Reference Group (CRG) was formed to provide ongoing input to WMP. This group was formed by inviting participants of earlier events to nominate for ongoing involvement. It also included representation from the Department of Water and Environmental Regulation and GeoCatch, as key supporting partners in development of the WMP. Facilitated workshops with this group were held to develop the vision, management objectives (AHA 2017a, 2017b) and management strategies and actions (AHA 2018) for the WMP.

1.4.2 Aboriginal consultation

Aboriginal people are important stakeholders. In recognition of Aboriginal people as the traditional custodians of country, and understanding the particular significance of waterways to Aboriginal people, additional consultation was undertaken to facilitate input to the WMP.

The draft management objectives were presented to the South West Boojarah (SWB) Working Party via the South West Aboriginal Land and Sea Council (SWALSC) in May 2017. An overview of the Revitalising Geographe Waterways Program was also provided at a Working Party meeting in November 2017.

The Aboriginal Heritage Survey was undertaken with representatives of the Aboriginal community (members of the SWB Working Party and the Harris family, as nominated by SWASLC) in February 2018, encompassing the study areas of all three plans included in the RGW program. The Survey was facilitated by Brad Goode and Associates (2018) and included briefings and a bus tour of key sites of the Toby Inlet study area for discussion of scientific investigations, future management actions and the content of the plan. Information from this consultation has been considered in the development of management objectives and actions in this WMP.

The study area is within the South West Boojarah Indigenous Land Use Agreement Area, which is one of six Indigenous Land Use Agreement areas that form part of the South West Native Title Settlement Area[4]. There is a historical camping ground within the survey area, which has been lodged as an Aboriginal Site under the Aboriginal Heritage Act (1972) and is awaiting an outcome.

[4] Current information on the South West Native Title Settlement: http://www.noongar.org.au

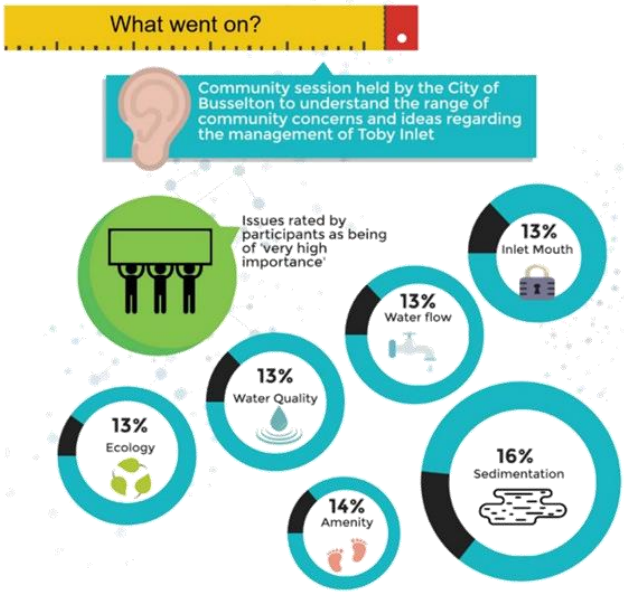

Figure 6. Outcomes from identifying and rating management tissues for Toby Inlet at the *Community Views* consultation session, March 2016.

2 Management Issues

The consultation process lead to the development of nine focus areas for management as follows:

- Sedimentation
- Amenity
- Water flow
- Water quality
- Toby Inlet mouth
- Ecology
- Recreation and education
- Heritage
- Governance

A summary of key management issues and information for these focus areas is provided in this section.

2.1 Sedimentation

Extensive sediment deposition is evident in much of Toby Inlet, with deposits in the upper reach of seasonally exposed during low water levels. Although sediment accretion in estuaries is a natural long-term process, it has been accelerated in Toby Inlet by increased sediment loads from the catchment and by excessive growth of algae in response to nutrient enrichment (discussed further in the section on water quality). Sediments deposits in Toby Inlet broadly comprise two sources: soils from the catchment, transported to and deposited in the Inlet; and accumulation of organic material within the Inlet. There is concern about the build-up of sediment in Toby Inlet for the following reasons:

- Poor amenity due to loss of open water vistas and unpleasant odours of exposed sediment during low water levels.
- Blocking of water flow in the inlet, preventing flushing of nutrients and organic material from the system.
- Reduced depth throughout the Inlet, restricting fish movement and creating potential for fish stranding in shallow pools.
- Smothering of benthic habitats, potentially impacting ecology.
- Reduced depth restricting recreational activities such as use of watercraft.

Areas of deposition downstream of Caves Road are generally sandy to a depth of 0.5m over clay and lateritic rock, and considered to be recent deposition from catchment sources (Norrish 2005, ENV 2007). Sandy deposits are also evident in other parts of the Inlet but these have not been characterised. Aerial photographs of the area show that substantial sediment deposits have been present for more than 20 years (Figure 7). These sediments have been identified as potential acid sulphate soils (ENV 2007, Figure 8) and the implications of this for management are discussed in Section 4.1.

Siltation from catchment sources is associated with clearing and drainage. Clearing of vegetation mobilises soils, and artificial drainage often creates unstable banks and channels, contributing sediment downstream. Earthworks and drainage for residential development results in exposed soils susceptible to erosion, and can be observed in drains within the Toby Inlet catchment (add photo).

Urban development in close proximity to Toby Inlet is often considered a key source of sediment. Diversion of flows may have decreased potential for flushing of sediments through the system to the ocean, exacerbating accumulation of 'sediment slugs'.

In downstream sections of Toby Inlet, accumulation of organic material has contributed significantly to sedimentation. Monosulfidic black ooze (MBO) has been found in the lower reach of Toby Inlet, from a point approximately 700m downstream of Caves Road Bridge (ENV 2007, Ward et al. 2009; Figure 8). MBO commonly forms in areas of high primary productivity, where seasonal growth and decomposition of algae results in accumulation of soft organic material with high concentrations of iron monosulfides (Ward et al. 2009). Growth of phytoplankton and filamentous macroalgae in Toby Inlet has been enhanced by increased nutrient loads from the catchment. MBO presents a risk of rapid acidification when disturbed, causing deoxygenation. Analysis of these sediments did indicate high potential for acidification, but also found that acid neutralising capacity (ANC) may be sufficient to buffer this effect (Ward et al. 2009).

"There used to be little streams 25 years ago. They have all been filled in and the birds and vegetation suffers." Community views report 2016

Figure 7. Comparative aerial photographs of sediment deposition in Toby Inlet downstream of Caves Road, from 2018 (left) and 1997 (right).

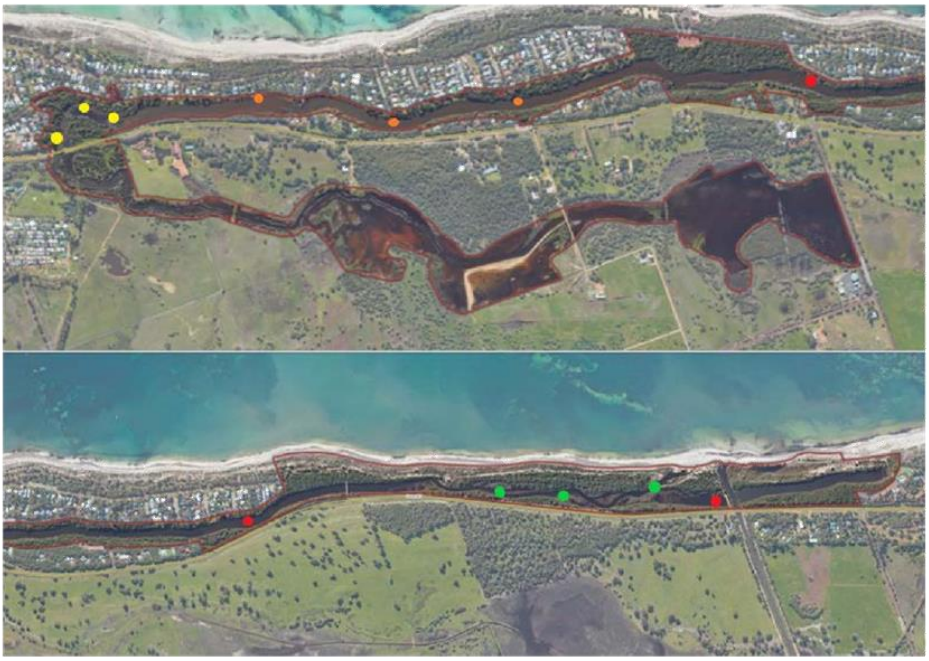

Figure 8. Acid sulphate soil and monosulfidic black ooze (MBO) presence in Toby Inlet sediments. Yellow markers show sand-dominated sediments with potential acid sulphate soils but no MBOs found in 2007 study. Orange sites show MBOs and potential acid sulphate soils in 2007 study. Green sites show no potential acidity or MBOs found in 2009 study. Red sites show MBOs and potential acid sulphate soils in 2009 study.

2.2 Amenity

Amenity describes the attractiveness of a place, and the 'visual' appeal of Toby Inlet was the characteristic most valued by participants in community consultation. Amenity was rated as one of the most important management issues, showing that people are concerned about threats to the amenity of Toby Inlet. The issue of amenity in Toby Inlet is directly related to sedimentation, water quality and ecology. Amenity is also linked to recreation and access, which provide opportunities for the public to enjoy Toby Inlet.

During low water levels, exposure of sediment deposits reduces amenity associated with open water vistas, and can result in unpleasant odours. The loss of amenity is a key reason that sedimentation in Toby Inlet has been identified as the highest-rating management issue.

In relation to water quality, seasonal macroalgal blooms are common in some parts of the inlet due to high nutrient concentration and still conditions. These masses of filamentous algae are unsightly, and cause unpleasant odours when they decompose. The algae also provide good habitat for non-biting midge larvae which may contribute to nuisance populations. As noted in Section 2.1, this material also accumulates in the Inlet and contributes to sedimentation problems.

Phytoplankton blooms occur occasionally in Toby Inlet, but have not been persistent and are usually dominated by harmless species. Isolated blooms of blue-green algae, which create a public health risk, occurred in May 2013 and February 2018, but did not persist. Further decline in water quality has potential to increase algal blooms in Toby Inlet, impacting amenity and recreation.

Quindalup Special Character Area

The Quindalup Special Character Area (SCA) Policy was developed by the (then) Shire of Busselton in 1996 to guide urban development in a way that maintains the natural amenity of the area. The Toby Inlet study area is located within this policy area. The character of the area is described as *a relaxed holiday atmosphere, this is attributable to its low density of housing which is contained within a bush and seaside setting, surrounded by natural environs.* The policy provisions apply to all public and private land within the SCA. The Quindalup SCA Policy notes the extensive remnant vegetation on private and public land in the area as a significant characteristic, and outlines development controls to protect native vegetation.

2.3 Water flow

Water flow within Toby Inlet has been significantly altered through drainage and diversion since European settlement. Notably, the catchments of Carbunup River, Station Gully (aside from interchange at the culvert) and a number of other smaller waterways have been diverted and no longer connects to the Inlet or contribute to its flow. Prior to this, Toby Inlet was connected to the Deadwater and outflow to the ocean was via the current Station Gully outlet (anecdotal). There is also a perception by some community members that construction of dams in the catchment has contributed to reduced flow (including the Dunsborough Lakes development).

Reduced catchment flows are considered to have two main consequences: reduced winter flushing, contributing to poor water quality and sedimentation; and less frequent connection to the ocean. The issue of reduced ocean connectivity is discussed further in Section 2.5.

There is community support for increasing water flows from catchment sources with the aim of mobilising sediment deposits within the Inlet. Altering water inflows may improve water quality through:

- Increasing summer/autumn flow to reduce water residence time and so reduce potential for algal growth.
- Diluting nutrient concentrations by adding lower nutrient-content inflows.
- Increasing winter velocity to scour sediments.

Potential for reconnecting catchment flows to Toby Inlet has been investigated through the *Reconnecting Toby Inlet* hydrological modelling project (Frazer and Hall 2018), and this management option is discussed further in Section 4.3.

2.4 Water Quality

2.4.1 Surface Water

Water quality in Toby Inlet and its tributaries has declined due to increased loads of sediments and nutrients, and poor flushing. Sources of excess nutrients include runoff from agricultural and residential areas, and leachate from septic systems in nearby residential areas (DoW 2010). Elevated nutrient levels typically cause increased growth of algae, including microscopic algae (phytoplankton) and filamentous algae (macroalgae), which impact amenity and can pose a public health risk.

Nitrogen levels in the Toby Inlet are consistently higher than ecosystem protection guidelines for estuaries, particularly in spring and summer (Figure 9a). Concentrations tend to be higher in upstream sites, and are lowest near the ocean entrance in summer and autumn. This may reflect opening of the sand bar in summer autumn period and a limited flushing effect upstream.

Phosphorus concentrations in Toby Inlet are highly variable and while average values are below the ecosystem protection guideline, samples frequently exceed this throughout the Inlet (Figure 9b). Extremely high total phosphorus occurs during summer at the more upstream sites, while concentrations near the ocean outlet are low. This may reflect ocean flushing, but may be due to uptake of phosphorus by filamentous macroalgae.

While nutrient concentrations appeared higher in the most upstream site, phytoplankton growth is greater lower in the Inlet (indicated by chlorophyll a, Figure 9c). Many types of phytoplankton are harmless, but at high densities can have unpleasant odours and form unsightly scums. Some species are toxic to humans and animals, including fish. Phytoplankton sampling by DWER since 2012 shows that the levels in Toby Inlet are mostly below the recreational guideline of 20,000 cells/mL (Figure 9e). However, harmful algal species have been found frequently at low densities. Blooms of blue-green algae have been detected twice since 2012.

Macroalgal blooms are currently more problematic than phytoplankton in Toby Inlet (Figure 10). They are not toxic but are unsightly and can cover large areas of water, restricting access and impacting visual amenity. Macroalgae also provides ideal habitat for breeding of nuisance midges. When large blooms of macroalgae decompose, this reduces oxygen levels in the water and sediments. Accumulation of this material has contributed to the formation of sulfidic sediments, including MBO. Although excessive growth of macroalgae is a serious management concern, no assessment or monitoring of species or biomass has been undertaken.

Fish deaths have occurred in Toby Inlet in late September 2006 (limited information available) and on 6 March 2014 (about 1000 fish). The 2014 incident was a result of stranding of fish associated with extremely low tides draining the lower sections of the Inlet. Fish deaths can be caused by low oxygen conditions, harmful phytoplankton or by stranding in warm shallow waters. Low oxygen levels have been associated with phytoplankton blooms in Toby Inlet, and fish have been observed congregating near the closed mouth of the Inlet when oxygen is low.

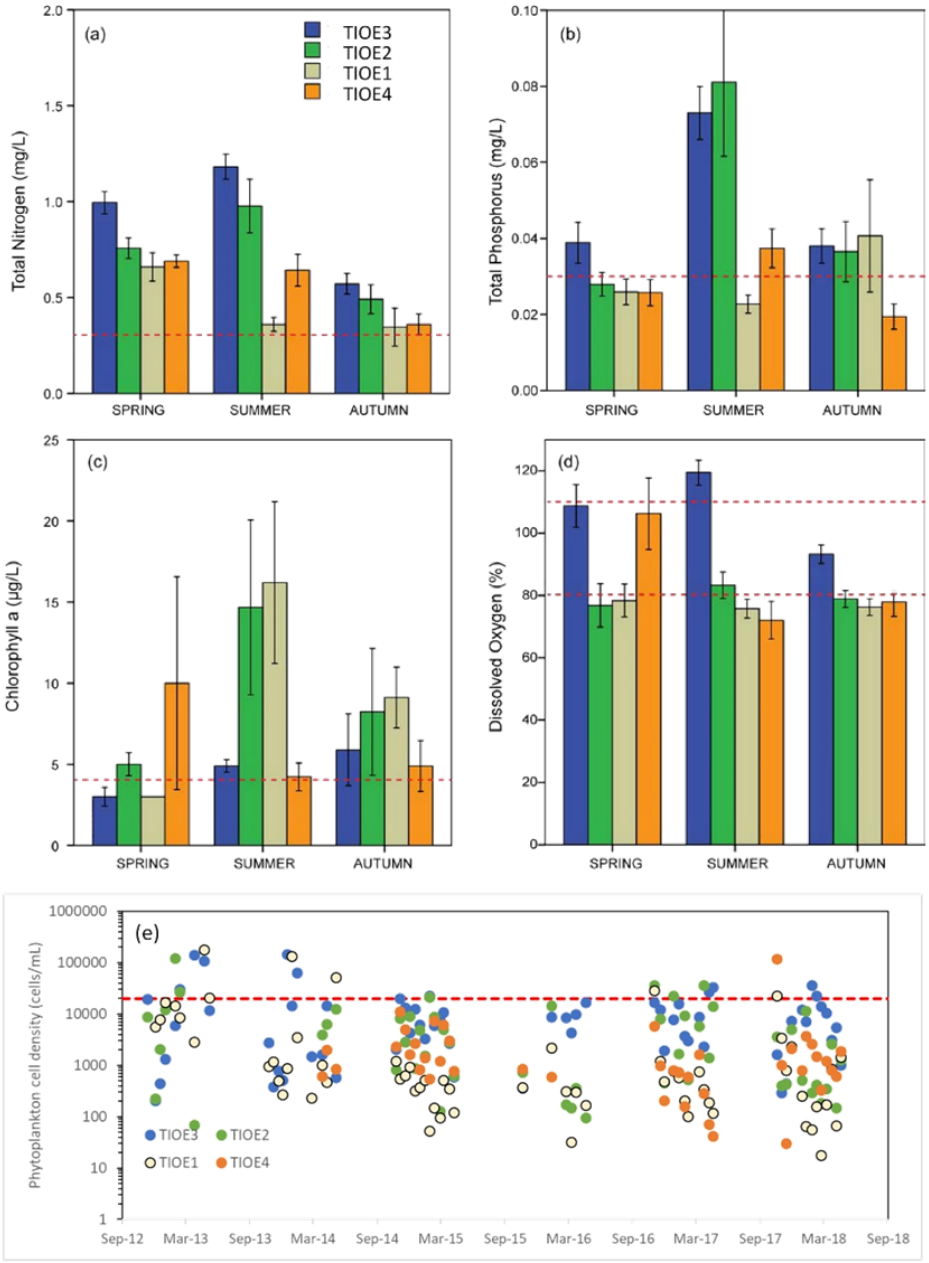

Figure 9. Average concentrations of water quality indicators (a-d) and phytoplankton density (e) in Toby Inlet (data courtesy DWER (DWER 2018). Sites TIOE3, 2 and 1 are located east to west respectively from Quindalup Siding Road to the ocean exchange and TIOE4 is just near the culvert exchange with Station Gully, as shown in Figure 1. Red dashed lines are guideline values for protection of estuarine ecosystems (a-d) and recreational use (e) (ANZECC and ARMCANZ 2000). Note logarithmic scale in (e). Error bars are +/- standard error.

Figure 10. Macroalgae growing in Toby Inlet (DoW 2010).

2.4.2 Groundwater

On the coastal plain, groundwater and surface water are closely related. Summer water levels in wetlands are often expressions of the superficial aquifer. Groundwater quality around Toby Inlet and in catchment areas is not well understood. Though there are numerous monitoring bores in the catchment, sampling has been inconsistent and there has been no analysis of data. This was not raised as an issue during community consultation, but could have implications for future management.

There have been concerns raise by community members in the past (late 1990s) and very recently about salt water intrusion in groundwater in the Dunsborough foreshore area generally, as a possible cause for the declining health of Peppermint trees. Dunsborough Coast and Land Care (DCALC) initiated a groundwater study for Dunsborough foreshore and Toby Inlet in partnership with the (then) Water and Rivers Commission. Fourteen monitoring bores were installed for assessment of salinity, nutrients and pH. However, results of the sampling program are not publicly available.

2.5 Toby Inlet ocean exchange

The common understanding among the community is that reduced water flow from the catchment has reduced the natural opening of Toby Inlet to Geographe Bay. The status of the sand bar has direct influence on water quality and water levels. When the sand bar is closed during summer, water quality is poor and conducive to algal growth. When the sand bar is open, tidal flushing dilutes the nutrient concentrations and reduces the residence time, limiting algal growth. When the sand bar is closed during winter, water levels in Toby Inlet can become high enough to cause localised flooding problems for nearby residential properties.

A memorandum of understanding for artificial opening of the sand bar was signed by key management bodies in June 2000, including the (then) Shire of Busselton, (then) Water and Rivers Commission, GeoCatch and Water Corporation. This specified that the preferred management for Toby Inlet and

Station Gully was as a common ocean outlet. The purpose of opening the sand bar was to prevent flooding of nearby properties and to increase tidal flushing to improve water quality. Managing a single ocean outlet became difficult owing to extensive sand build-up. In early 2005, the (then) Department of Environment trialled excavation of a separate ocean outlet for Toby Inlet with the aim of improving water quality in the Inlet through tidal flushing.

Although water quality is generally improved by ocean exchange, problems have occurred with excessively low water levels during low tides. Very low water levels impede recreational boating activities and lead to greater exposure of sediment deposits, reducing visual amenity and causing poor odours. There is also anecdotal evidence of fish stranding in upstream areas at very low tides.

Declining water quality has likely increased the demand for the Inlet to be opened, and this will be an important ongoing component of managing Toby Inlet.

2.6 Ecology

Toby Inlet and associated wetland area retains many important ecological attributes, which contribute to regional biodiversity and are valued highly by the local community. The vegetation communities within and surrounding Toby Inlet and associated wetlands have intrinsic conservation value and provide important habitats for terrestrial and ecological functions. The aquatic habitats of these systems are closely linked to the fringing vegetation and support diverse populations of aquatic fauna and waterbirds.

The ecology of Toby Inlet provides amenity value and supports recreational activities such as fishing, watercraft use, bird-watching and exercise pastimes. A summary of the ecological components of the Toby Inlet study area and associated management issues is provided below.

2.6.1 Vegetation

The foreshore of Toby Inlet contains large areas of intact vegetation, owing to preservations within reserves, most of which are managed by the City. The management of vegetation and conflicting landscaping and gardens of adjoining properties is a key issue.

A recent survey of flora and vegetation was completed for the City by Ecoedge (2017). The study area contains at least fifty native species within seven different vegetation communities (0), including two vegetation units that fit criteria for the Coastal Saltmarsh threatened ecological community[5]. Weston (1997) described three broad types of vegetation communities: fringing wetland and estuarine, coastal scrub, and forests and woodlands.

There are at least fifty species of weeds present in the study area, and 14 of these are considered environmentally significant (0the most significant of these is Arum lily (*Zantedeschia aethiopica*), which currently occurs as localised infestations at many sites (Ecoedge 2017). Bridal creeper and grassy weeds are also problematic. Grassy weeds continue to invade native vegetation, and there is progressive encroachment of lawns into reserve areas in some locations. There are number of potentially invasive garden escapees that pose a threat in the study area. Dumping of garden refuse

[5] EPBC Act 1999

and direct planting of exotic species within reserves, as well as spreading from private gardens, contribute to this problem.

Other key threats to vegetation are unauthorised clearing within public reserves and unmanaged access.

Despite the presence of a range of environmental weeds, the foreshore vegetation is considered generally in fair to good condition. Forty percent of vegetation is rated as very good to excellent condition. The study area is also in high proximity to a Regional Ecological Linkage. In addition to the conservation value of the flora itself, fringing vegetation of wetland areas is a vital component of wetland health. Functions include:

- supporting terrestrial and aquatic food webs;
- habitat for terrestrial and aquatic fauna;
- foreshore stabilisation;
- maintaining cooler temperatures;
- interception of nutrients and sediments in runoff; and
- nutrient uptake and processing.

Future works to rehabilitate fringing vegetation must be mindful of maintaining suitable amenity to avoid future conflicts with landowners and preventing ongoing encroachment of lawns and gardens into reserve areas.

2.6.2 Birds

Birds are an important part of the Toby Inlet ecosystem and are appreciated by members of the community and by visitors. No formal bird monitoring data is available for the study area, however surveys were conducted during spring in 1996 and results are reported in Clay (2005). This survey recorded 68 bird species including 26 waterbirds and 42 forest birds. Given the level of community interest in birds there is an opportunity to engage people in data sharing to better understand bird populations of Toby Inlet.

The surrounding vegetation and open water areas are important habitat for birds. Threats to bird populations include degradation of habitats, predation by domestic and feral animals, and disturbance from human activities.

2.6.3 Aquatic Fauna

Though impacted by modified hydrology, nutrient enrichment and sedimentation, Toby Inlet is considered to provide important fish habitat. Sheltered estuarine systems such as Toby Inlet are important for fish breeding, particularly for estuarine species which require both fresh- and salt-water for different phases of growth and reproduction. Estuaries also tend to be highly productive, supporting aquatic invertebrate communities that provide an important food resource for fish and waterbirds.

Aquatic invertebrates

Aquatic invertebrate sampling of Toby Inlet in 1997 found a combination of estuarine and freshwater species, with more diverse wetland-type communities at upstream sites. Though species diversity was high at some sites, the system was considered dominated by cosmopolitan species characteristic of a degraded system (Streamtec 1997).

Recent sampling downstream of Caves Road in November 2017, prior to opening of the sand bar, also found higher-diversity wetland communities in more upstream regions and lower-diversity estuarine communities downstream (Tweedley et al. 2018). This study found a relatively diverse aquatic invertebrate community, including species that are intolerant of pollution and low oxygen levels, indicating a fairly healthy ecosystem. Other notable fauna observed during the study by Tweedley et al. (2018), were: Southern Bobtail Squid (*Euprymna tasmanica*, Blue Swimmer Crab (*Portunus armatus*) and Western King Prawn (*Penaeus plebejusl*). A list of taxa from both these studies is provided in Appendix 7.

The effect of opening of the sand bar on the invertebrate population, and implications of this in terms of food resources for fish and birds, have not been assessed. The recent sampling provides a useful baseline for future assessments in Toby Inlet.

Fish

Fish in Toby Inlet have long provided a food resource for Aboriginal people, and fishing has been a valued recreational pursuit for many years. There is a general perception that the fish population has declined in Toby Inlet, though it is still perceived as providing important fish habitat.

A recent study of the fish population in Toby Inlet (Tweedley et al. 2018) provides the first formal description of the fish population. For this study, fish were sampled in November 2017 and March 2018, prior to and following the opening of the sand bar (11th December 2017). The type of fish found were typical of those found in other south west estuaries and include estuarine and marine species and some freshwater-estuarine fish. Several marine species known for using estuaries as nursery areas were present. Mosquitofish, which is aggressive to native fish and not able to be controlled, was also recorded.

Following opening of the sand bar in December 2017, fish density remained similar to before opening, but species diversity increased owing to an increase in the number of marine species which recruited into the estuary. However in general, the fish population was more influenced by timing of life cycles than by opening of the sand bar.

2.6.4 Other Fauna

The terrestrial vegetation provides habitat for many species of birds and other fauna, including two mammal species of conservation significance: the Critically Endangered[6] Western Ringtail Possum (Ngwayir, *Pseudocheirus occidentalis*); and the priority 3 listed[7] Quenda (Southern Brown Bandicoot). A site survey and summary of observations by local residents in November 1996 found these two mammals, Grey kangaroos present, two species of frogs, 13 species of reptiles and the possible

[6] Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WA); (EPBC Act)
[7] Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WA)

presence of Water Rat (Rakali, *Hydromys chrysogaster*) (Hart et al. 1997) (Appendix 6.). The Brush-tailed Phascogales (*Phascogale tapoatafa*) may also be present, and is listed as a conservation-dependent species[8].

Impacts on vegetated habitat, predation by domestic and feral animals and fire are the main threats to these native mammals. Remnant vegetation is at risk of degradation from physical disturbance, inappropriate fire regimes, weed invasion and physical disturbance.

2.7 Recreation and Education

Toby Inlet provides significant recreational and educational opportunities. Activities such as fishing, swimming and paddling on the Inlet have been important recreational pastimes since early European settlement during the mid to late 1800's. Bird watching and other passive enjoyment activities are also important. Toby Inlet is the focus of a number of tourism accommodation businesses on and around the inlet. The visual amenity and opportunity for recreational pursuits are critical to both visitors and local residents alike. Poor water quality and sedimentation problems restrict access for recreation within the water, and visual amenity and odour problems affect other recreational activities. This affects a broad cross section of the community, visitors and local businesses.

Despite these problems, a number of trails, beaches and open space adjoining the Toby Inlet continue to provide recreational opportunities and these are highly valued by the community. However, unmanaged access has led to disturbance of foreshore vegetation and erosion of banks in some locations. There is significant potential for improving recreational and educational opportunities in and around Toby Inlet, by addressing water quality and sediment problems, improving facilities and providing information resources.

Private use of reserves and private jetties

Considerable areas of foreshore reserves do not have public access and some areas adjacent to private property owners are managed for private purposes. The condition of foreshore vegetation and bank stability in these areas varies from remnant vegetation in good condition to extensive clearing and bank instability. Illegal clearing of native vegetation within public reserves to improve views is an ongoing problem. Private use of public reserves by residents conflicts with access by the broader public; but some residents are concerned that increased public access will create security issues.

These privately used foreshore reserves include a number of private jetties. They have been present in Toby Inlet for many years and in general have not been raised as a key management issue. However there is an issue relating to the structural integrity of these jetties and the materials they are built from. For example a jetty made from plastic drums has come apart and a plastic drum floated in the Inlet. In addition, building of more jetty structures may cause inappropriate disturbance to foreshore areas. The City currently has no policy regarding these structures.

[8] Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WA)

2.8 Cultural Heritage

2.8.1 Aboriginal heritage

Toby inlet holds significant cultural value for Wadandi people. In pre-European times, local groups traditionally gathered to conduct ceremonies and take advantage of food resources. Following European settlement, the area continued to be used for camping, with evidence of several historical camps still present from times when Aboriginal people were not permitted to live in town (BGA 2018). There is a historical camping ground within the survey area, which has been lodged as an Aboriginal site under the *Aboriginal Heritage Act 1972* and is awaiting an outcome.

On-site discussions with local Aboriginal representatives were held during the preparation of this plan. The group described historical use of Toby Inlet and surrounds by Aboriginal People for camping and fishing and the substantial changes to the area since European settlement (BGA 2018). The group related the decline in water quality and fish abundance to the substantial changes in drainage and development of the surrounding lands. A key issue raised by the group was minimising additional access and infrastructure for recreation, while retaining access for Aboriginal people.

2.8.2 European History

The area around Toby Inlet was an important part of early European colonisation. Quindalup was the primary settlement established in 1866, supporting local timber industry, and is the site of the original school. There is also a history connected to whaling.

This extract about European history is from the Management Plan prepared by Clay (2005):

Toby Inlet was named after Captain Jacob Toby, of the coastal schooner 'Ellen'. The Ellen used to take on water at Meelup, and while in the area Captain Toby would moor close to the mouth of Toby Inlet and barter with the local residents, exchanging knives, tools, sugar and tea for fresh produce (Guinness, 1984; Smith, pers.comm2004). In the 1800's Jack Molloy commenced construction of a boat in the sheltered waters of Toby Inlet near the sand bar. The boat was well into construction when the mouth broke out, and washed away the boat supports. The boat was buried by sand and left at the site. This incident is referred to as 'Molloy's Folly" (Smith, pers. comm.).

The European history of Toby Inlet, is documented by several authors (Guiness, 1984; Kinsella, 1990: Horwitz & Wardell-Johnson, 1996). Anecdotal evidence supports the fact that Toby Inlet used to be considerably deeper than it is today. In the 1920's the channel was deep enough for small boats, and due to the accretion of sediments, this is obviously no longer possible. In 1967 the Inlet was dredged by a very unsophisticated piece of equipment, along the north bank, from a point just west of the Edgewater subdivision to a point some 400 metres east of this sub-division. From this point to the ocean a channel was cut to allow passage for small boats (Ken Davies pers.comm.2004).

In 1994 the Water Authority constructed a bund across the Inlet, at the western end of Campion Way to allow for the maintenance of an existing water main. It is said by the locals that after maintenance had been completed, the bund was not completely removed, thus restricting water flow (Ken Davies pers.comm.2004).

2.9 Governance

Governance was not identified as a priority issue of concern in the community views session, but was indicated as an area needing change. It was recognised as an important focus area during the development of management objectives, and is clearly an important overarching issue for implementation of the WMP.

The independent review of water asset management (Hart 2014) highlighted the need for Toby Inlet to have a designated manager, which was further supported in the State Government response. The review acknowledged the work of the Toby Inlet catchment Group in developing the existing management plan (Clay 2005). However, implementation of this plan has been limited by a lack of funding and support from relevant organisations, and the management roles have not been clear.

The existing management plan is not connected to any targets or monitoring, so progress and outcomes have not been measurable. The community have been dissatisfied with the progress of management for Toby Inlet. Although there has been no formal tracking of progress, there is a general perception in the community that the ecological health of Toby Inlet has continued to decline (Hart 2014).

The review also recommended that identifying research needs should be a component of future management. Annual reporting to the community on the health of Toby Inlet and the effectiveness of management was also recommended, with government support, which will require clear goals/targets and associated monitoring.

> *Management of Toby Inlet is minimalist at best. The community-based Toby Inlet Catchment Group have developed a Management Plan for Toby Inlet, and could do a serviceable job of managing the Inlet if they had more funding and greater backup from CoB and DoW* (Independent Review - Hart 2014).

3 Management Objectives

Sixteen management objectives across the nine the focus areas are listed below. These objectives were strongly guided by community input. They provide important statements for future assessment of the implementation of this WMP.

3.1 Sedimentation

1. Reduce catchment sediments and contaminants from existing and new developments entering Toby Inlet.
2. Manage existing sediment to improve water quality, water flow and amenity of Toby Inlet.

3.2 Amenity

3. Improve visual amenity, public health and odours so that residents and visitors alike can enjoy Toby Inlet.

3.3 Water quality

4. Reduce and manage nutrients and other pollutants entering Toby Inlet to improve water quality and lessen the frequency and severity of algal blooms.
5. Minimise any additional nutrients entering Toby Inlet from new developments and agricultural intensification.

3.4 Water flow

6. Optimise all water flow in Toby Inlet to balance improvement of water quality, protection of ecological values and public amenity, while maintaining flood protection.

3.5 Toby Inlet ocean exchange

7. Actively manage the Toby Inlet mouth to maximise ecology, water quality and recreational values.

3.6 Ecology

8. Restore, maintain and protect the ecological values of Toby Inlet.
9. Reduce the impacts of threatening processes on the ecological values of Toby Inlet.

3.7 Recreation and Education

10. Improve and manage public access for recreational purposes that support the amenity and ecological values of Toby Inlet.
11. Facilitate appropriate water based recreational activities with consideration to the ecological values and water quality of Toby Inlet.
12. Raise community awareness of Toby Inlet's recreational, cultural and ecological values.

3.8 Cultural Heritage

13. Understand, protect and preserve the heritage values of Toby Inlet.

3.9 Governance

14. Develop and maintain partnerships and a collaborative approach between stakeholders and the community when managing Toby Inlet.
15. Involve the community in the future management of Toby Inlet.
16. Adopt evidence based decision making in the long term management of Toby Inlet.

4 Review of Management Options

Development of management strategies for Toby Inlet involved consideration of a range of potential initiatives. Some of these are based on fundamental waterway management approaches, such as minimising nutrient and sediment loads, and enhancing the important function of fringing vegetation. Other initiatives involve further work to better understand potential outcomes and challenges. Many of the strategies and actions build on community suggestions for future management of Toby Inlet.

4.1 Sediment Removal

There is strong community support for active removal of sediments from Toby Inlet. Community input indicates that this is driven by perceptions that sediment removal will lead to outcomes in the following areas:

- Flushing of water through the system to improve water quality.
- Removal of unsightly sediment deposits.
- Addressing unpleasant odours associated with exposed sediments.
- Deepening of the Inlet to improve boating conditions.
- Improved conditions for fish.

Removal (dredging) of sediment could be progressed if it can be justified on ecological grounds, rather than for amenity outcomes only.

4.1.1 Challenges

Previous investigations (ENV Australia 2007) have shown a layer of sandy sediments approximately 0.5m deep in the area of obvious sediment deposits downstream of Caves Road. This area would be a likely focus of sediment removal should it be deemed an appropriate action. This area did not contain MBOs but did contain potential acid sulphate soils (PASS). Potential for acidity means sediment removed would require treatment for disposal.

The deeper area downstream was assessed as having a surface layer of MBO in the sediments and also contained PASS (ENV Australia 2007). The presence of MBOs is probably linked to a history of macroalgal blooms in the area. Disturbance of MBOs can cause deoxygenation, heavy metal release, nutrient release, sulphide toxicity and bad odours.

Removal and transport for disposal would involve significant costs, and may also cause physical disturbance to the environment. Further investigations would be needed to prioritise areas for sediment removal; determine volumes and characteristics of the sediment to inform disposal options; and assess potential environmental impacts. Volumes of sediment have been estimated for the large area of deposition downstream of Caves Road as:

- Deepening the channel to -0.4m AHD: 1684m^3
- Removal of large sandy deposit to 0.4m AHD: 714m^3

4.1.2 Potential outcomes of removal

The main objective associated with this approach is improved amenity: removal of sediment deposits would improve water vistas for some local residents; and deepening the Inlet would improve access for watercraft. Outcomes for water quality and ecology and potential impacts of removal are also possible but not well understood, and further investigation is needed to assess potential for both beneficial outcomes and negative impacts.

Removal of sediment in the upper and lower reaches of Toby Inlet was included in hydrological modelling done for the *Reconnecting Toby Inlet* project. This indicated some potential for improvement in water quality through increased water circulation in the estuary: reducing the bathymetry to -0.5mAHD (removing about 300mm of sediment) would create additional regular flushing of about 2%, or 100m (Frazer and Hall 2017).

Deeper conditions may also improve open water habitat for fish and birds, but this is not known. There are risks of negative impacts on the environment, which may in turn have negative effects on amenity. Risks associated with sediment removal in Toby Inlet include:

- disturbance of acid sulphate soils and monosulfidic black ooze;
- physical disturbance of bed and bank habitats; and
- damage to fringing vegetation.

Before a recommendation can be made with regards to sediment removal, management should focus on defining priority areas for sediment management and understanding the costs and benefits of removal.

4.1.3 Alternatives to removal

Other than removal, some potential management options to address sedimentation in Toby Inlet are:

- Minimising future sediment loads into the system.
- Mobilisation of sediment through agitation to resuspend sand into the water column, using a hydraulic sludge pump during high flows, to facilitate its movement into to the ocean.
- Acceptance of sediment deposits and rehabilitation (e.g. planting) of these areas to improve ecology.

4.2 Toby Inlet ocean exchange

Connectivity of Toby Inlet to the ocean has direct effects on water quality and water levels. Potential connections are via a culvert into Station Gully, which is intermittently open to the ocean; and via a direct separate channel to the west of Station Gully. The status of these connections depends on flows coming from the catchment and the nature of the sand bars, determined by coastal processes.

The Toby Inlet Ocean Entrance Study in 1999 (Rogers and Associates 1999) identified a common channel for Station Gully and Toby Inlet as the more desirable option to improve water quality and alleviate flooding, as the combined flows from the systems have greater potential to maintain the opening. In June 2000, a Memorandum of Understanding (MoU) was developed which specified management of Toby Inlet/Station Gully with a common ocean outlet to ensure:

1. *Protection of residential properties from flooding.*
2. *Maintenance of tidal flushing to maintain water quality in the Inlet.*
3. *Protection of rural properties from flooding.*

This MoU was signed by representatives of the (then) Shire of Busselton, Water Corporation, Toby Inlet Catchment Group, (then) Water and Rivers Commission and the Geographe Catchment Council.

The *Reconnecting Toby Inlet* hydrodynamic modelling study (Frazer and Hall 2018) determined that a separate ocean connection for Toby Inlet resulted in tidal flushing of 72% of the Inlet, compared with only 36% flushing via Station Gully. A key difference for this study was additional bathymetric survey in the area, which showed that the narrow connection between Station Gully and Toby Inlet allowed only very limited exchange between the two waterways. Thus much greater flushing of Toby Inlet is achieved via a separate ocean connection.

This work also determined a minimum sill height for the channel of -0.15 m AHD to avoid excessive draining of the Inlet on low tides. Very low water levels have caused problems with past sand bar openings owing to increased exposure of sediments, and isolation of shallow pools that provide unfavourable conditions for aquatic fauna. Recommendations from this study were:

- The Toby inlet mouth is kept open throughout the year, with a minimum sill elevation of -0.15 m AHD from October to June to avoid very low water levels during low tides.
- Keeping the culvert between Station Gully and Toby Inlet open permanently.
- Potentially, to investigate a second cut for Toby Inlet if increased flushing of the upper estuary is considered necessary.

A telemetered data logging system is in place to monitor water levels and sill height of the ocean connection.

4.2.1 Summer - water quality protection

During 2017-2018 the opening of the mouth of Toby Inlet has been maintained. A draft operational procedure is in place to keep the sandbar open, with a minimum sill elevation of -0.15 m AHD (Appendix 2. The sand bar was opened in November 2017. It stayed open until late March 2018 and was re-opened on 6th April 2018. The feedback from the community on this management initiative has generally been positive.

4.2.2 Winter - flood protection

The *Reconnecting Toby Inlet* project recommends the ocean outlet be kept open all year (Frazer and Hall 2018). However, periodic closing of sand bar through natural processes during winter creates unpredictability in works requirements to achieve this. A trigger level for flood protection purposes would be useful to initiate opening of the sand bar in winter. Detailed water level data (15-minute intervals) from the telemetered monitoring system provides some useful information for setting trigger levels for winter sandbar opening.

Intense storms in May and June 2018 resulted in a high level of sand deposition on the beach and very high water levels in Toby Inlet. Despite large rainfall events, there was insufficient flow to naturally cut through the sand bar. Water levels were in the vicinity of 1.5m (above sea level AHD) from 10th to 14th June, following a series of rainfall events from the 25th May (Figure 11). Photographs of the area

during this time show minor flooding in adjacent lands at these water levels (Figure 12). The sand bar was opened on 13th June 2018, lowering water levels to about 0.8m within two days. This opening was effective, and the outlet remained open intermittently for about four weeks. Rising water levels initiated further opening of the sand bar on 24th July when water levels were around 1.1m. In this instance the sand bar closed within two days.

Maintaining the ocean outlet throughout winter may incur excessive costs if it closes frequently. An appropriate trigger level would direct works only when there is a risk of flooding, and coincide with sufficient flows to maintain the opening. Given the flooding observed when water levels were at 1.5m, and the lack of a consistent channel when opened at around 1.1m, an appropriate trigger level would be at a height between these levels.

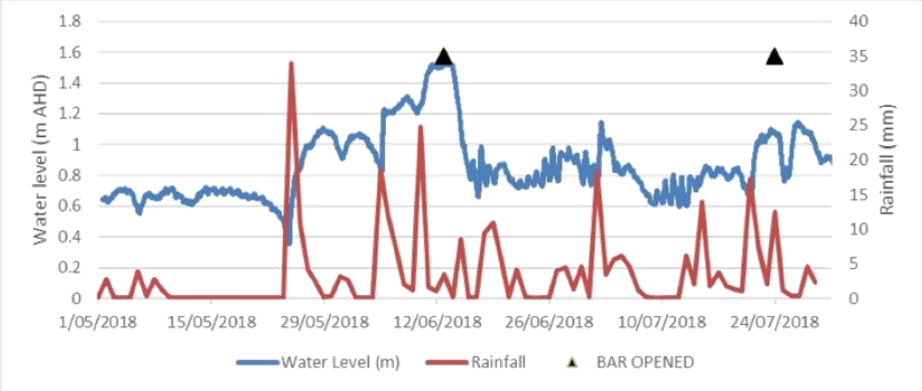

Figure 11. Water levels (blue line) at the Toby Inlet ocean outlet, daily rainfall (red line) and times when sand bar was opened (black markers) during May, June and July 2018. Rainfall data from BoM (2018).

Figure 12. Photos showing minor flooding in the vicinity of Toby Inlet from 11th - 13th June 2018.

4.3 Reconnecting catchment flows

Water flow within Toby Inlet has been significantly altered since European settlement. Notably, the Carbunup River and a number of other smaller waterways have been diverted and no longer connects to the Inlet or contribute to its flow. These changes have resulted in a significant decline in flows and influence the accumulation of nutrients and sediments in the system. The *Reconnecting Toby Inlet* hydrological modelling study investigated options to reinstate flow through Toby Inlet through reconnection of catchment tributaries (Frazer and Hall 2018).

Increasing water flow may improve water quality through dilution of nutrients and by reducing water residence time (flushing). Nutrient concentrations in Station Gully, with a predominately agricultural catchment, are higher than in Toby Inlet, so additional flow from this source may have a negative effect on water quality through increased nutrient loads (Frazer and Hall 2018). Flushing of the estuary has minimal effect on water quality during winter, but is needed during summer when water quality problems occur. However, owing to seasonal flows, there is little potential for catchment flows to provide summer flushing, do the reconnection of catchment sources would not provide this benefit (Frazer and Hall, 2018). There is insufficient water available from other sources, such as Dunsborough lakes dams, to provide summer and autumn flows.

Increasing catchment inflows is also perceived as an option for addressing sedimentation problems. Although the volume of flow through Toby Inlet would be increased by additional catchment water flows, the flat landscape means that flow velocities would remain low, and would not facilitate sediment scouring (Frazer and Hall 2018). It is also worth considering that if velocities were sufficient to mobilise sediment, there may also be a risk of increased sediments from the catchment to Toby Inlet (not assessed).

4.4 Recreation Planning

Community feedback on recreation in and around Toby Inlet was sought during the consultation process and via a specific online survey (City's *Your Say* platform). These forums have indicated very

clearly that management should focus on encouraging passive recreation, and on improvements to existing access rather than increasing accessibility.

Aboriginal consultation revealed a strong desire to maintain a passive level of recreation in and around Toby Inlet. Representatives also suggested that additional infrastructure and signage in the area should be minimised.

An access management plan has been developed to identify existing recreational access and infrastructure in the study area and opportunities for improvements (SWE 2018). This plan identifies four categories for management:

i. Vegetated areas with no tracks: to be retained as high conservation value areas with no further access.
ii. Vegetated areas with existing tracks: to be improved and potentially linked to each other and parkland areas enhance access for recreation and management purposes (e.g. weed control and infill planting).
iii. Parkland cleared areas: existing high-use areas where improved infrastructure and formal paths would be appropriate and foreshore protection may be needed.
iv. Private property access only: not accessible for assessment and unlikely to be suitable for further public access.

Management options identified in the plan include improvements to existing tracks and the potential for additional tracks and/or a boardwalk; potential sites for canoe access, bird watching facilities, picnic facilities and outdoor classroom; and protection works for revegetation, weed control and erosion control. The concept plans for these options provide an ideal basis for further community consultation and project development.

4.5 Managing foreshore reserves

Foreshore reserves require improved management to protect remnant vegetation from weed invasion and physical disturbance from uncontrolled access. Revegetation is also needed in some degraded areas, particularly along banks where vegetation is important for stabilisation and ecological functions.

The Ecoedge (2017) vegetation survey report provides mapping of weeds that would form a basis for strategic control. This report also proposed five areas for revegetation based on size (≥ 1500m^2), accessibility for implementation, and low density of existing vegetation (Ecoedge 2017). These should be further considered in consultation with the community. Weed control and revegetation is needed to ensure protection of natural values in the study area. Some further planning may be needed to direct these efforts.

Recreation and access planning also provide recommendations for areas requiring weed control and revegetation in association with managing access and addressing foreshore erosion, and improving recreation opportunities (SW Environmental 2018). Pathways provide opportunities to formalise boundaries of reserves or interfaces between areas of parkland and natural vegetation.

Some foreshore reserves adjacent to private properties do not have public access to undertake an assessment of management issues or opportunities for improvement. The condition of foreshore

vegetation, bank stability and integrity of private jetties in this area varies. A process of assessment of these areas is needed that identifies:

- inappropriate management of public land;
- jetty structures that require maintenance or removal;
- areas of recreational value for the broader community;
- required management actions to conserve ecological values; and
- potential fire risk.

This process could also be used to develop relationships with local landholders and foster community stewardship for ongoing management, such as through formation of localised *Friends of* groups that could partner with the Toby Inlet catchment Group. In addition, a policy relating to current and future jetty structures would be valuable to minimise potential impacts of the structures and ensure adjacent foreshore areas are protected.

4.6 Catchment management

The portion of the catchment closest to the Inlet has experienced rapid urban development and this is projected to continue into the future. Unsewered urban areas of Quindalup have been identified as a significant nutrient source, particularly through the critical summer months. Sewerage infill works in this area are imminent (update progress as needed). Once completed, the connection of properties to this infrastructure will be vital to ensure outcomes from this investment. There may need to be targeted awareness campaign to maximise connection.

The broader Toby Inlet catchment contains a range of land uses with significant portions dominated by native vegetation, beef grazing, lifestyle blocks and highly developed urban or commercial areas. Management of the broader catchment is beyond the scope of this plan. However, as the catchment has substantial influence on the health of waters within the study area, it is logical that its implementation would support initiatives that reduce catchment sources of nutrients and sediments. GeoCatch has a lead role in catchment management including improved land use management practices, waterway restoration and educational approaches. In addition, the Toby Inlet Catchment Group has long advocated catchment management and could partner with GeoCatch to extend initiatives in the Toby Inlet catchment.

There is also a role for land use development planning in catchment protection. Proposals for changes in land use and new developments can trigger the imposition of new environmental protection requirements. This applies directly to the objective: *reduce catchment sediments and contaminants from existing and new developments entering Toby Inlet.* The use of planning approaches is part of the governance framework for this plan.

4.7 Governance arrangements

The independent review of water asset management (Hart 2014) highlighted the need for Toby Inlet to have a designated lead manager. The City was recognised as the most appropriate manager for Toby Inlet, and this has been supported by the Western Australian Government in its response to the review. It is appropriate that the City adopts this role, given its management responsibility for a large proportion of adjacent foreshore reserves. Although the City is responsible for overall implementation

of management actions, several key stakeholders also have important roles, outlined below. These roles and responsibilities are also summarised in Table 1, Section 6.

The City's management responsibility is generally limited to the study area and does not extend into the broader catchment. Ongoing management initiatives in the catchment, in particular to address issues of nutrient enrichment and sedimentation, are a fundamental component of waterways management. GeoCatch, with the support of DWER, is the lead manager for catchment management. The Water Corporation has management responsibility for its rural drainage network. This network extend into the Station Gully catchment, but is not part of the existing Toby Inlet catchment.

DWER has an ongoing role in providing support for the management of Toby Inlet through continued involvement in water science, modelling and monitoring. If the implementation of this WMP is to be funded through ongoing investment in a broader program for Geographe Bay catchment waterways, DWER is likely to continue to have an important project management and networking role.

The Toby Inlet Catchment (TIC) Group also has an active role in the management of Toby Inlet and its catchment, with a long history in management planning and on-ground works. Members of TIC Group are important advocates in the community for protection of Toby Inlet, increasing support for, and recognition of, improved management. The group continues to undertake restoration activities such as weed control, revegetation and feral animal control. This greatly assists with management of public reserves, and should continue to be supported by the City.

Establishment of "Friends of Reserves" groups for sections of Toby Inlet foreshore has been suggested during consultation as a way of fostering community stewardship to assist with and maintain restoration efforts. These groups could partner with TIC Group, increasing overall capacity. The City recognises the valuable contribution of volunteers to environmental management, and has a commitment to supporting volunteer groups such as TIC Group and Friends of Reserves groups.

The City also has an important role in its planning capacity. Through the *Revitalising Geographe Water*ways program, the City has been responsible for the *Optimising Planning Tools* project to review the potential role of planning in water resource protection.

4.8 Research needs

Research is needed to enable assessment and reporting on progress of management initiatives and to fill knowledge gaps. Research outcomes need to feed back into management planning through an adaptive process. The key research areas for Toby Inlet are summarised below.

Water quality: Ongoing water quality monitoring is an essential part of long-term assessment and reporting for waterway health. There appears to be an adequate sampling program for open waters of Toby Inlet. Investigative sampling within of tributaries and groundwater in the Toby Inlet catchment should be considered to ensure information requirements for prioritising and reviewing management initiatives are met.

Water flow: Assessment of the potential for existing flows to move sediment in association with resuspension of sediment through agitation may require further modelling or a trial.

Sediments: If removal of sediment is deemed appropriate in the future, further studies of physical and chemical characteristics will be needed to inform priority locations, the removal technique and disposal options.

Bird life: There has been little formal surveying of bird life of Toby Inlet, so the overall importance of the study area for providing bird habitat and the particular sites of importance are not well understood. There is an opportunity for community-based surveying to assist in prioritising management initiatives (e.g. habitat restoration) and in developing information resources for visitors.

Aquatic fauna: Fish and aquatic invertebrates are good indicators of waterway health. Recent research has provided baseline information for future monitoring and reporting. Community involvement in this research has highlighted the potential for educational opportunities that engage people in the management of Toby Inlet.

Aquatic flora: There have been no studies of macroalgae and other aquatic plants in Toby Inlet and associated wetlands. Aquatic flora has an important structuring role, with a strong seasonal influence on habitat and water quality and hence on aquatic fauna and food web interactions. The extent and composition of macroalgal growth (as blooms or at non-nuisance levels) have not been formally monitored and may provide a good indicator of water quality.

5 Management Strategies and Actions

The management strategies and actions included here have been developed to work towards meeting the management objectives and vision for Toby Inlet. Specific actions have been grouped into strategies for each of the management focus areas, although many have potential outcomes for several objectives. A framework for implementing the WMP is provided in Section 6, including the roles and responsibilities of key stakeholders and a process for ongoing action planning, reporting and review.

5.1 Toby Inlet ocean exchange

5.1.1 Strategy OE1: Optimal management of Toby Inlet ocean exchange

Effective management of the Toby Inlet ocean exchange has clear outcomes for water quality by through dilution of nutrient concentrations and preventing algal growth. Establishing a minimum sill height during summer will reduce areas prone to sediment exposure and associated problems with visual amenity and odours. Management of the sand bar is also important in mitigating the flood risk for adjacent properties.

Management actions:

OE1.1 Maintain Toby Inlet ocean outlet, the Station Gully culvert and the Station Gully outlet in accordance with Operational Procedures in Appendix 2.

OE1.2 Monitor the status of the outlet through a telemetered system to determine when opening of the sand bar is necessary.

OE1.3 Ensure the culvert between Station Gully and Toby Inlet will be left open to improve water quality in the upper reach of Toby Inlet, east of the ocean outlet.

5.2 Sedimentation

5.2.1 Strategy S1: Investigate sediment removal

There is strong community support for active removal of sediments from Toby Inlet, however the main objective associated with this approach is improved amenity. Outcomes for water quality and ecology and potential impacts of removal are not well understood, and further investigation is needed. An alternative approach to mobilising sediment may be mechanical agitation of sediments in depositional areas during high flows. There is community support to further investigate potential to mobilise deposited sediment.

Management actions:

S1.1 Defining priority areas for sediment management and determine sediment composition and volume for these areas, building on previous sediment investigations.

S1.2 Assess potential outcomes and impacts of sediment removal from priority areas and undertake a cost/benefit analysis of strategic sediment removal.

S1.3 Assess whether sediment agitation would facilitate mobilisation and flushing of sediment deposits on Toby Inlet.

5.2.2 Strategy S2: Prevent further sedimentation

Existing land uses in the catchment and ongoing development are likely to continue to contribute additional sediment to the drainage system, wetlands and Toby Inlet. Minimising sources of sediments and trapping mobile sediments before they reach receiving waters is important to prevent further deposition.

Management actions:

S2.1 Improve understanding of sediment sources and transport through water quality monitoring (refer to WQ1.6).

S2.2 Develop an education approach to reducing sediments inputs from the catchment.

S2.3 Identify and ensure management of potential erosion problems from new developments and changes in land use during the planning process, through implementing the *Better Urban Water Management* framework.

S2.4 Investigate key sediment sources in the catchment and potential for works to stabilise drains and increase sediment trapping within the drainage network.

5.2.3 Strategy S3: Rehabilitate exposed sediment deposits

Revegetation of exposed sediments may address amenity issues. It would also stabilise the sediments, provide additional habitat, and trap additional sediments and nutrients entering the Inlet.

S3.1 Identify areas of exposed sediments that could be planted to improve habitat and amenity and stabilise sediments.

S3.2 Undertake trial revegetation of samphire in exposed sediment.

5.3 Water quality

Increased nutrient loads from the catchment are a major cause of water quality decline. Actions to reduce point and non-point sources of nutrients are thus a fundamental component of managing water quality. Management of the sand bar to provide flushing during summer and autumn is a key strategy to improve water quality in Toby Inlet (Strategy OE1). However, ocean flushing does little to address water quality issues in the upper reach of Toby Inlet or in the upstream wetland environments.

5.3.1 Strategy WQ1: Reducing nutrient sources from the catchment

Nutrients are a key driver of algal blooms, so ongoing load reduction actions are a fundamental part of management. Infill sewerage works is important to addressing nutrient sources from adjacent residential areas. Reducing nutrient inputs at the catchment level is a long-term management initiative, fundamental to protecting water quality in receiving aquatic environments.

Management actions:

WQ1.1 Completion of scheduled infill sewerage works in residential areas adjacent to Toby Inlet.

WQ1.2 Review the sewerage works once completed, and address any lack of connection to sewerage infrastructure through education campaigns or incentives if deemed necessary.

WQ1.3 Ensure Geographe Bay catchment management initiatives extend to Toby Inlet catchment, including: implementation of best management practices; and community education to reduce inputs from gardening and livestock activities in urban and special rural areas.

WQ1.4 Increase potential for nutrient assimilation in the rural drainage network in conjunction with sediment trapping and through restoration.

WQ1.5 Identify opportunities for reducing nutrient, sediment and pollutant sources through upgrades to stormwater infrastructure.

WQ1.6 Continue current water quality monitoring within Toby Inlet, and determine required monitoring for associated wetlands and catchment tributaries, to ensure information requirements for prioritising and reviewing management initiatives are met.

WQ1.7 Support educational campaigns that aim to reduce nutrients in runoff through individual and community actions (e.g. Bay OK) and investigate options to improve nutrient management in public open space.

WQ1.8 Minimise future nutrient sources from new development and land use change at the planning stage through implementing the *Better Urban Water Management* framework.

WQ1.9 Support implementation of the Vasse Wonnerup wetlands Geographe Bay Water Quality Improvement Plan.

5.4 Ecology

5.4.1 Strategy E1: Effectively manage foreshore reserves

Foreshore reserves in the study area contain important areas of vegetation, provide habitat for native fauna and contribute to heathy aquatic ecology. These reserves present considerable opportunity for conservation, however active management is needed to address threats of weeds, pests, unmanaged access, clearing of native vegetation, and vegetation decline.

Management actions:

E1.1 Prepare and implement a prioritised works program for weed control, revegetation and feral animal control.

E1.2 Support community efforts in weed control, revegetation and feral animal control.

E1.3 Ensure revegetation in high amenity areas is appealing and maintains vistas to increase community support for these activities.

E1.4 Effectively management recreational access to protect and enhance the key values of reserve areas.

E1.5 Create awareness of reserve boundaries through bollards and signage where appropriate.

E1.6 Develop information resources for landholders to raise awareness of reserve boundaries, the importance of fringing vegetation, weed problems, and the restrictions on clearing native vegetation and building jetty structures.

E1.7 Assess foreshore reserve areas that have no public access and develop appropriate management actions to benefit the broader public.

E1.8 Develop a policy for jetties that ensures structural integrity and protection of adjacent foreshore areas and prevents establishment of new structures.

5.4.2 Strategy E2: Understanding fauna

There is limited formal knowledge of the fauna of Toby Inlet. Recent research on fish and aquatic invertebrates has provided an important baseline and has had excellent outcomes for community engagement. While there is some knowledge of the occurrence of other fauna in the study area such as birds and mammals, this is not based on formal surveys. Increased understanding of fauna can be achieved through scientific and community based approaches to improve information, and sharing this knowledge with the broader community.

Management actions:

E2.1 Support further research on aquatic and terrestrial fauna and bird populations to inform management initiatives and assess outcomes.

E2.2 Pursue a community science approach to collecting bird data.

E2.3 Develop information resources to increase community interest and understanding of fauna.

5.5 Amenity, Recreation and Education

Strategies for amenity, recreation and education have been combined owing to overlap between these focus areas. All relate to the interaction between people and Toby Inlet, and improving potential enjoyment.

5.5.1 Strategy ARE1: Improving facilities for community appreciation

There is a need to formalise access and improve recreational facilities around Toby Inlet, but with a clear focus on passive recreational pursuits, such as walking and running, bird watching, fishing and non-motorised water sports. The *Access Management Plan* for Toby Inlet provides an excellent basis for improving recreational opportunities and access around Toby Inlet (Appendix 9. Although this has been developed with consideration of outcomes of previous community consultation, further review and feedback from the community will be required prior to its implementation.

Management actions:

ARE1.1 Seek community input on the *Access Management Plan* for Toby Inlet (SW Environmental 2018), and subsequently develop and implement appropriate access-ways and recreational infrastructure.

ARE1.2 Determine requirements for additional parking in support of improved facilities.

ARE1.3 Enhance bird habitat in connection with existing and potential bird watching sites.

ARE1.4 Encourage bird watchers to join with a community science approach to collecting bird data.

ARE1.5 Support schools in using Toby Inlet as an outdoor learning environment, including provision of information resources and consideration of an outdoor classroom.

5.5.2 Strategy ARE2: Providing informative resources

Management strategies around education often include interpretive signage. However given the desire for passive recreation in the Inlet and minimal facilities, extensive signage is not appropriate around Toby Inlet. Some signage regarding the values and management of the Inlet, and access points would be appropriate. Information in other forms would also be valuable for those who are interested, including learning resources for school groups. This includes printed resources and online information.

Management actions:

ARE2.1 Develop appropriate signage in connection with improved access and facilities to inform the community about: ecological values of Toby Inlet; location and use of access and facilities; and management initiatives underway.

ARE2.2 Prepare and distribute fact sheets and educational material, printed and online, for key management focus areas, relevant to schools, community members and natural resource managers.

ARE2.3 Continue to update the Revitalising Geographe Waterways website with information on Toby Inlet and its management.

5.6 Culture and Heritage

Heritage values in the vicinity of the Toby Inlet study area include traditions and history of Aboriginal people and European settlement.

5.6.1 Strategy CH1: Recognising Aboriginal custodianship

Toby Inlet holds significant cultural value for the local Wadandi people, as important place for food resources and camping. The area has continued to be an important camping and fishing area since European settlement. An area of campgrounds has been lodged for assessment as a Registered Aboriginal Site under the *Aboriginal Heritage Act* (1972).

Aboriginal representatives indicated clearly that they did not support extensive cultural information on signs in the area. However, acknowledgement of the significance of the area to Aboriginal people may be appropriate on signs for other purposes, and in other information resources suggested in this

plan. There is also potential to recognise Aboriginal peoples' connection to the area through other means, such as artwork or design of recreational facilities.

As traditional custodians, Aboriginal people are concerned about declining health of the environmental and should also be given opportunities to contribute to the future management of Toby's Inlet.

Management actions:

CH1.1 In partnership with local Aboriginal people, include reference to traditional custodianship of the waterways and land in development of information resources.

CH1.2 Manage future access in a way that avoids additional disturbance and considers protection of potential sites of Aboriginal significance – however activities of local Aboriginal people, such as fishing, camping, the gathering of bush foods and family recreational and educational activities, should not be restricted by implementation of this plan.

CH1.3 Seek to improve partnerships with the Nyungar community to increase their involvement in the management, protection and restoration of Toby Inlet and the study area.

CH1.4 Consult further with Aboriginal representatives in regard to specific works which result from this plan.

CH1.5 Support programs that engage the Aboriginal community in implementation of works associated with this plan.

5.6.2 Strategy CH2: Conserve historical values

There is a great deal of history associated with the whaling industry and European settlement in the study area. It is important that future generations have access to historical information and that historical sites are maintained.

Management actions:

CH2.1 Identify and ensure appropriate maintenance of sites historical importance.

CH2.2 Develop interpretive material to increase understanding of local history, and to promote, appreciate and access historical sites.

5.7 Governance

Management of Toby Inlet requires leadership which is most appropriately provided by the City. There is strong interest in the management of Toby Inlet from a broad range of stakeholders with varying interests and responsibilities. A collaborative approach to management is needed, that facilitates ongoing input from stakeholders and provides support to active members of the community, in particular the Toby Inlet Catchment Group. Partnerships with researchers are also valuable to improve our understanding of the system, inform management decisions and monitor success or otherwise of management actions.

5.7.1 Strategy G1: Defined and collaborative management

The City has coordinated the development of this WMP, and has overall responsibility for implementation. However other stakeholders have important roles in undertaking and supporting many management actions. Collaboration of stakeholders will therefore be essential to successful future management of the Toby Inlet study area. Major stakeholders and their roles in the future management of Toby Inlet and the study area are summarised in Table 1.

Management actions:

G1.1 City to consider securing management order over waterways and adjacent public lands in study area, to facilitate implementation.

G1.2 Establish a Management Advisory Committee comprised of representatives from the City, Toby Inlet Catchment Group, Department of Water and Environmental Regulation, Department of Biodiversity Conservation and Attractions, Water Corporation, GeoCatch, South West Catchments Council, Aboriginal representatives, and community members.

G1.3 Support the Toby Inlet Catchment Group as active participants in planning, on-ground works, and as a key link to the community.

G1.4 Facilitate the development of locally-active Friends of Toby Inlet groups to advocate and coordinate on-ground work in reserves and on private property.

G1.5 Define and resolve issues around vesting of Unallocated Crown Land.

5.7.2 Strategy G2: Evaluate and adapt management actions

Implementation will require an ongoing process of monitoring and evaluation of outcome, and future management will need to be informed by this proves and by new information gained through research. Long term water quality data is a fundamental tool for defining management issues and assessing outcomes of management. While an established routing monitoring program is in place for Toby Inlet itself, available data for catchment tributaries and groundwater is inconsistent. Biological monitoring approaches are valuable to assess current and future ecological health, and to provide interesting information for the community. Recent sampling of aquatic fauna has helped establish a baseline for future assessment of decline or improvement. Despite the nuisance growth of macroalgae in Toby Inlet, there has been no assessment of species or estimates of biomass.

Management actions:

G2.1 Continue monitoring of water quality in Toby Inlet.

G2.2 Review monitoring requirements for catchment tributaries and groundwater.

G2.3 Support future sampling of aquatic fauna.

G2.4 Undertake assessment of macroalgal growth.

G2.5 Ensure timely reporting of monitoring and research outcomes to the management advisory group.

G2.6 Review future management actions in light of monitoring and research outcomes.

6 Implementation

6.1 Roles and responsibilities

The lead role of the City in the future management of Toby Inlet will be recognised through endorsement and adoption of this WMP. This will task the City with responsibility for coordinating implementation, however key stakeholders will have ongoing roles in many aspects of the WMP. These roles and responsibilities are defined in Table 1.

As captured in action G1.2 a Management Advisory Group is recommended to oversee implementation of this WMP, comprised of representatives from the City, Department of Water and Environmental Regulation, Department of Biodiversity Conservation and Attractions, Water Corporation of WA, GeoCatch, Wadandi representatives and broader community representatives.

6.2 Implementation process

An adaptive process of action planning, works, evaluation and reporting is recommended for the WMP, summarised by Figure 13. The strategies and actions presented provide a basis for planning actions for a specified period of time, dependent on available budgets and identified priorities. This would be a key role of the Management Advisory Group. Outcomes of these actions are measured through adequate monitoring, with results assessed in terms of progress towards the management objectives and vision. Reporting of outcomes to the community is essential to maintain community support and this forum would provide an opportunity to gain input to the next action planning cycle.

Table 1. Key stakeholders for future management of Toby Inlet and main roles and responsibilities.

Stakeholder	**Roles and Responsibilities**
City	Overall implementation of the WMP. Management of reserves. Maintenance of Toby Inlet ocean exchange. Operation of Station Gully culvert. Support to community groups.
Toby Inlet Catchment Group	Undertaking weed control, revegetation and feral animal control activities. Advocating protection and enhancement of Toby Inlet. Representing community interests in future management of Toby Inlet and reserves. Leadership for citizen science opportunities.
South West Boojarah Working Party	Advocating protection and enhancement of Toby Inlet. Providing input ion management decisions to ensure maintenance of cultural values.

	Engagement of Aboriginal people in management decisions and actions.
Department of Water and Environmental Regulation	Monitoring of water quality. Technical contributions to management decisions. Coordination of future investment in waterways management through Revitalising Geographe Waterways.
GeoCatch	Support to private landholders to improve land and waterway management in the catchment. Educational programs to minimise nutrient and sediment loads. Education, habitat restoration, and community group support for protection of Western Ringtail Possums.
Water Corporation	Maintenance of Station Gully ocean exchange. Maintenance (ownership) of Station Gully culvert. Managing flooding risk.
Department of Biodiversity, Conservation and Attractions	Implement wildlife management and recovery plans. Community group support for protection of Western Ringtail Possums. Providing information about flora and fauna.
South West Catchments Council	Support for funding opportunities.
Friends of reserves groups	Future role in local-level advocacy and management actions.

Figure 13. Implementation process for the Toby Inlet Waterway Management Plan.

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8 Appendices

Appendix 1. Land tenure listing

Current vesting details for public lands in the study area.

TYPE	PIN	RESERVE	CURRENT PURPOSE/LEGAL USE	CURRENT VESTING
Reserve	1039621	23572	RECREATION	City
Reserve	532402	31944	PUBLIC RECREATION	City
Reserve	532412	31944	PUBLIC RECREATION	City
Reserve	11342942	31591	PUBLIC RECREATION	City
Reserve	11767346	46	LANDSCAPE PROTECTION AND	City
Reserve	1341995	26122	PUBLIC RECREATION	City
Reserve	1051637	26122	PUBLIC RECREATION	City
Reserve	532482	26122	PUBLIC RECREATION	City
Reserve	1208973	26122	PUBLIC RECREATION	City
Reserve	1107483	36262	PUBLIC RECREATION	City
Reserve	532377	36262	PUBLIC RECREATION	City
Reserve	532386	36262	PUBLIC RECREATION	City
Reserve	532394	36262	PUBLIC RECREATION	City
Reserve	1153703	45169	PUBLIC RECREATION &	City
Reserve	1112023	46086	PUBLIC RECREATION, DRAINAGE	City
Reserve	1214511	46086	PUBLIC RECREATION, DRAINAGE	City
Reserve	532322	26524	PUBLIC RECREATION	City
Reserve	532329	26524	PUBLIC RECREATION	City
Reserve	532342	26524	PUBLIC RECREATION	City
Reserve	532350	26524	PUBLIC RECREATION	City
Reserve	532494	36429	RECREATION	City
Reserve	1186196	45436	PUBLIC RECREATION	City
Reserve	1215108	45436	PUBLIC RECREATION	City
Reserve	523991	29844	PUBLIC RECREATION	City
Reserve	523992	29844	PUBLIC RECREATION	City
Reserve	523989	37416	WATER SUPPLY	Water Corporation
Reserve	524084	40677	DRAINAGE	Water Corporation
Reserve	1287021	26225	RECREATION & ROAD	DEPARTMENT OF LANDS (SLSD)
Reserve	1034792	32282	DRAIN	DEPARTMENT OF WATER
UCL	11676813			
UCL	1237261			
UCL	11154519			
UCL	11154521			
UCL	11627253			
UCL	11608890			
UCL	11154520			

Appendix 2. Operational Procedures for maintenance of Toby Inlet sand bar

OPERATIONAL PRACTICE AND PROCEDURE

OPENING AND MAINTENANCE OF THE TOBY INLET SAND BAR AND CULVERT

PURPOSE

This document details the procedures that apply to the opening and maintenance of the Toby Inlet sand bar and the culvert between Toby Inlet and Station Gully. The main purposes of opening the sand bar are to improve water quality in the inlet by increasing water flushing and reduce the likelihood of algal blooms and to mitigate flooding risks to neighbouring properties.

OE1.4 Ensure the ocean outlet is kept open through the period from 1 November to 31 April to improve water quality, with a minimum sill height of -0.15m AHD to prevent excessively low water levels.

OE1.5 Open the sand bar during the period 1 May to 31 October if water levels exceed an interim trigger value of 1.3m AHD. The outcomes of this approach will be monitored and management guidelines adapted accordingly.

SPECIFICATIONS

Ocean entrance

Summer – water quality improvement

1. The Toby Inlet mouth is maintained open from 1 November to the 30 April at a minimum sill elevation of -0.15m AHD.
2. Opening to be facing approximately 45 degrees eastward, to the width of inlet.
3. Opening to be located in area highlighted in aerial photo below, subject to seasonal varibility of inlet's position.
4. Opening works to coincide with rising tide and greatest tidal variations (as practicable).
5. Sand removed to be deposited to the east of opening and flattened out to not impede access by pedestrians and horses.
6. Machinery to access site via Quindalup boat ramp.
7. Sand bar to be open within two weeks of notification received of it being closed.

Winter – flooding mitigation

1. The Toby Inlet mouth is to be opened when water levels reach 1.3m AHD, causing a potential flooding risk to neighbouring properties and infrastructure.
2. Opening to be located in area highlighted in aerial photo below, subject to seasonal varibility of inlet's position.
3. Opening works to coincide with lowering tide.
4. Sand removed to be deposited to the east of opening and flattened out to not impede access by pedestrians and horses.
5. Machinery to access site via Quindalup boat ramp.

Culvert

1. Culvert between Station Gully drain and Toby Inlet to remain open all year around.

RESPONSIBILITIES

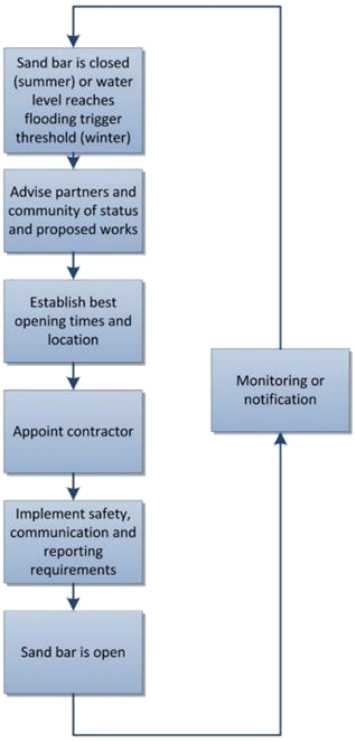
The City is responsible for:

- Monitoring status of the Toby Inlet ocean entrance, with a minimum of a check per fortnight during the period of October to May.
- Organising, supervising and funding the manual opening of the Toby Inlet ocean entrance by machinery as required from October to June.
- Notifying other stakeholders (including the Water Corporation and Department of Water and Environmental Regulations) and the public of upcoming maintenance works.
- Ensuring public safety during operations, including at works site and upstream of Toby Inlet.
- Keep records of sand bar opening times.
- Maintaining the culvert between Toby Inlet and Station Gully in a good state of repair and open all year around.

The Water Corporation and the Department of Water and Environmental Regulations are responsible for:

- Notifying the City if it becomes aware that the Toby Inlet entrance has closed.
- Provide any information that may assist the City in managing the opening of the Toby Inlet ocean entrance.
- Opening Station Gully ocean outlet for flood protection purposes as necessary.

PROCESS TO BE FOLLOWED IF SAND BAR CLOSES (FLOWCHART)



Appendix 3. Plant species found within the Toby Inlet study area

List of vascular flora identified in the study area during survey by Ecoedge (2017)

FAMILY	SPECIES	COMMON NAME	NATURALISED
Aizoaceae	*Carpobrotus edulis*	Hottentot Fig	*
Anacardiaceae	*Schinus terebinthifolius*		*
Apiaceae	*Apium prostratum*	Sea Celery	
Apiaceae	*Centella asiatica*	Centella	
Apiaceae	*Daucus glochidiatus*	Australian Carrot	
Apocynaceae	*Vinca major*	Blue Periwinkle	*
Araceae	*Zantedeschia aethiopica*	Arum Lily	*
Araliaceae	*Hedera helix*		*
Araliaceae	*Trachymene pilosa*	Native Parsnip	
Asparagaceae	*Acanthocarpus preissii*		
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	*
Asparagaceae	*Lachenalia bulbifera*		*
Asphodelaceae	*Trachyandra divaricata*		*
Asteraceae	*Carduus pycnocephalus*	Slender Thistle	*
Asteraceae	*Cotula coronopifolia*	Waterbuttons	*
Asteraceae	*Gazania linearis*		*
Asteraceae	*Hypochaeris glabra*	Smooth Cats-ear	*
Asteraceae	*Olearia axillaris*	Coastal Daisybush	
Asteraceae	*Osteospermum jucundum*		*
Asteraceae	*Osteospermum ecklonis*		*
Asteraceae	*Senecio jacobaea*	Ragwort	*
Asteraceae	*Sonchus asper*	Rough Sowthistle	*
Asteraceae	*Symphyotrichum squamatum*	Bushy Starwort	*
Boraginaceae	*Echium plantagineum*	Paterson's Curse	*
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak	
Chenopodiaceae	*Atriplex hypoleuca*		
Chenopodiaceae	*Atriplex prostrata*		
Chenopodiaceae	*Rhagodia baccata*	Berry Saltbush	
Chenopodiaceae	*Salicornia quinqueflora*	Beaded Samphire	
Chenopodiaceae	*Suaeda australis*	Seablite	
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Cupressaceae	*Callitris preissii*	Rottnest Island Pine	
Cyperaceae	*Baumea juncea*	Bare Twigrush	
Cyperaceae	*Carex divisa*	Divided Sedge	*
Cyperaceae	*Ficinia nodosa*	Knotted Club Rush	
Cyperaceae	*Gahnia trifida*	Coast Saw-sedge	
Cyperaceae	*Lepidosperma gladiatum*	Coast Sword-sedge	
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	
Dilleniaceae	*Hibbertia cuneiformis*	Cutleaf Hibbertia	
Ericaceae	*Leucopogon parviflorus*	Coast Beard-heath	

FAMILY	SPECIES	COMMON NAME	NATURALISED
Euphorbiaceae	*Euphorbia paralias*	Sea Spurge	*
Euphorbiaceae	*Euphorbia terracina*	Geraldton Carnation Weed	*
Fabaceae	*Acacia cochlearis*	Rigid Wattle	
Fabaceae	*Acacia cyclops*	Coastal Wattle	
Fabaceae	*Acacia littorea*		
Fabaceae	*Acacia saligna*	Orange Wattle	
Fabaceae	*Chamaecytisus palmensis*	Tagasaste	*
Fabaceae	*Dipogon lignosus*	Dolichos Pea	*
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria	
Fabaceae	*Lotus subbiflorus*		*
Fabaceae	*Melilotus indicus*		*
Fabaceae	*Podalyria sericea*		*
Fabaceae	*Templetonia retusa*	Cockies Tongues	
Fabaceae	*Trifolium campestre*	Hop Clover	*
Geraniaceae	*Geranium molle*	Dove's Foot Cranesbill	*
Geraniaceae	*Geranium solanderi*	Native Geranium	
Geraniaceae	*Pelargonium capitatum*	Rose Pelargonium	*
Goodeniaceae	*Dampiera trigona*	Angled-stem Dampiera	
Goodeniaceae	*Scaevola crassifolia*	Thick-leaved Fan-flower	
Hemerocallidaceae	*Dianella revoluta*	Blueberry Lily	
Iridaceae	*Watsonia meriana*	Bulbil Watsonia	*
Juncaceae	*Juncus kraussii*	Sea Rush	
Lauraceae	*Cassytha racemosa*	Dodder Laurel	
Liliaceae	*Lilium* sp.		*
Loganiaceae	*Logania vaginalis*	White Spray	
Moraceae	*Ficus carica*	Common Fig	*
Myrtaceae	*Agonis flexuosa*	Peppermint	
Myrtaceae	*Eucalyptus rudis*	Flooded Gum	
Myrtaceae	*Melaleuca cuticularis*	Saltwater Paperbark	
Myrtaceae	*Melaleuca osullivanii*		
Myrtaceae	*Melaleuca rhaphiophylla*	Swamp Paperbark	
Myrtaceae	*Melaleuca* sp.		*
Myrtaceae	*Melaleuca viminea*	Mohan	
Orchidaceae	*Cyrtostylis robusta*		
Orobanchaceae	*Parentucellia viscosa*	Sticky Bartsia	*
Oxalidaceae	*Oxalis corniculata*	Yellow Wood Sorrel	*
Oxalidaceae	*Oxalis pes-caprae*	Soursob	*
Papaveraceae	*Fumaria muralis*	Wall Fumitory	*
Phyllanthaceae	*Phyllanthus calycinus*	False Boronia	
Plantaginaceae	*Plantago lanceolata*		*
Poaceae	*Ammophila arenaria*	Marram Grass	*
Poaceae	*Austrostipa compressa*		
Poaceae	*Austrostipa flavescens*		
Poaceae	*Avena fatua*	Wild Oat	*

FAMILY	SPECIES	COMMON NAME	NATURALISED
Poaceae	*Briza maxima*	Blowfly Grass	*
Poaceae	*Bromus diandrus*	Great Brome	*
Poaceae	*Lagurus ovatus*	Hare's Tail Grass	*
Poaceae	*Lolium perenne*	Perennial Ryegrass	*
Poaceae	*Piptatherum miliaceum*	Rice Millet	*
Poaceae	*Poa porphyroclados*		
Poaceae	*Sporobolus virginicus*	Marine Couch	
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass	*
Polygalaceae	*Comesperma virgatum*	Milkwort	
Polygonaceae	*Muehlenbeckia adpressa*	Climbing Lignum	
Polygonaceae	*Rumex brownii*	Swamp Dock	*
Ranunculaceae	*Ranunculus muricatus*	Sharp Buttercup	*
Rhamnaceae	*Spyridium globulosum*	Basket Bush	
Rosaceae	*Rosa chinensis* x *multiflora*		*
Santalaceae	*Exocarpos sparteus*	Broom Ballart	
Santalaceae	*Santalum acuminatum*	Quandong	
Solanaceae	*Solanum linnaeanum*	Apple of Sodom	*
Stylidiaceae	*Stylidium adnatum*	Common Beaked Triggerplant	
Thymelaeaceae	*Pimelea argentea*	Silvery Leaved Pimelea	
Typhaceae	*Typha orientalis*	Typha	

Appendix 4. Revegetation species the Toby Inlet study area

Suggested revegetation species for main soil types in the Toby Inlet study area (Ecoedge 2017)

Saline Soils:
Atriplex prostrata
Ficinia nodosa (Knotted Club Rush)
Juncus kraussii (Sea Rush)
Melaleuca cuticularis (Saltwater Paperbark)
Salicornia quinqueflora (Beaded Samphire)
Suaeda australis (Sea Blite)

Loams:
Acacia saligna (Orange Wattle)
Agonis flexuosa (Peppermint)
Eucalyptus rudis (Flooded Gum)
Exocarpos sparteus (Broom Ballart)
Hakea varia
Hibbertia cuneiformis (Cutleaf Hibbertia)
Jacksonia furcellata
Kunzea micrantha
Melaleuca viminea (Mohan)
Spyridium globulosum (Basket Bush)
Viminaria juncea (Swish Bush)

Quindalup Dunes:
Agonis flexuosa (Peppermint)
Spyridium globulosum (Basket Bush)
Acacia littorea
Acacia cochlearis
Hibbertia cuneiformis (Cutleaf Hibbertia)
Leucopogon parviflorus
*Hardenbergia comptoniana (*Native Wisteria)
Lepidosperma gladiatum (Sword Sedge)

Appendix 5. Birds of Toby Inlet and associated wetlands

Bird species reported to occur in the study area, from a survey by Clay and Clay (1996, cited in Comer and Clay 1999).

COMMON NAME	SPECIES NAME
Water Birds	
Hairy-headed Grebe	Poliocephalusi poliocephalus
Australasian Grebe	*Tachybaptus novaehollandiae*
Australian Pelican	*Pelecanus conspicillatus*
Darter	*Anhinga melanogaster*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Little Pied Cormorant	*Phalacrocorax melanoleucos*
White Faced Heron	*Ardea novaehollandiae*
Great Egret	*Egretta alba*
Sacred Ibis	*Threskiornis aethiopica*
Straw-necked Ibis	*Threskiornis spinicollis*
Yellow Billed Spoonbill	*Platalea flavipes*
Black Swan	*Cygnus atratus*
Australian Shelduck	*Tadorna tadornoides*
Pacific Black Duck	*Anas superciliosa*
Grey Teal	*Anas gibberifrons*
Australian Wood duck	*Chenonetta jubata*
Musk Duck	*Biziura lobata*
Pink-eared Duck	*Malacorhynchus membranaceus*
Hardhead	*Aythya australis*
Osprey	*Pandion haliaetus*
Eurasian Coot	*Fulica atra*
Purple Swamphen	*Porphyrio porphyrio*
Hooded Plover	*Charadrius rubricollis*
Black-fronted Plover	*Charadrius melanops*
Greenshank	*Tringa nebularia*
Silver Gull	*Larus novaehollandiae*
Caspian Tern	*Hydropgne caspia*
Crested Tern	*Sterna bergii*
Fairy Tern	*Sterna nereis*
Bush Birds	*Scientific Name*
Black-shouldered Kite	Elanus notatus
Whistling Kite	*Haliastur sphenurus*
Brown Goshawk	*Accipiter fasciatus*
Australian Kestrel	*Falco cenchroides*
Laughing Turtle-dove*	*Streptopelia senegalensis*
Common Bronze wing	*Phaps chalcopterai*
Red-tailed Black Cockatoo	*Calyptorhynchus magnificus*

White-tailed Black Cockatoo	*Calyptorhynchus baudinii/latirostris?*
Red-capped Parrot	*Purpureicephalus spurius*
Western Rosella	*Platycercus icterotis*
Australian Ringneck	*Barnardius zonarius*
Tawny Frogmouth	*Podargus strigoides*
Laughing Kookaburra	*Dacelo novaeguineae*
Sacred Kingfisher	*Halyconi sancta*
Rainbow Bee-eater	*Merops ornatus*
Welcome Swallow	*Hirundo neoxena*
Tree Martin	*Hirundo nigricans*
Richard's Pipit	*Anthus novaeseelandiae*
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*
Scarlet Robin	*Petroica Multicolor*
Rufous Whistler	*Pachycephala rufiventris*
Grey Shrike-thrush	*Colluricincla harmonica*
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Splendid Fairy-Wren	*Malurus splendens*
White-browed Scrub-Wren	*Sericornis frontalis*
Western Gerygone	*Gerygone fusca*
Western Thornbill	*Acanthiza inornata*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Varied Sitella	*Daphoenositta chrysoptera*
Rufous Treecreeper	*Climacteris rufa*
Red Wattle Bird	*Anthochaera carunculata*
Brown Honeyeater	*Lichmera indistincta*
New Holland Honeyeater	*Phylidonyris novaehollandiae*
Western Spinebill	*Acnathorynchus superciliosus*
Silvereye	*Zosterops lateralis*
Australian Magpie-Lark	*Grallina cyanoleuca*
Dusky Woodswallow	*Artamus cyanopterus*
Grey Butcherbird	*Cracticus torquatus*
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*

Appendix 6. Other Fauna likely to occur in study area

Fauna identified as present or likely to be present in the study area in the survey by Hart et al. (1997)

Frogs		
	Litoria adalaidensis* Litoria moorei* Crinia georgiana Heleioporus eyrie Limnodynastes dorsalis Pseudophryne glauerti Ranidella insignifera	
Reptiles		
Turtle	Chelodina oblonga*	Long-necked turtle
Gecko	Phyllodactylus marmoratus*	
Legless lizards	Aprasia repens Pygopus lepidopodus	
Dragon lizards	Pogona m. minor*	Western bearded dragon
Skinks	Bassiana trilineata* Cryptoblepharus plagiocephalus Egernia kingie* Egernia napoleonis* Glaphyromorphus australis Hemiergis peronei Lerista distinguenda* Menetia greyii* Morethia lineoocellata* Tiliqua r. rugose*	
Monitors	Varanus gouldii Varanus rosenbergi	
Snakes	Ramphotyphlops australis Drysdalia coronate Echiopsis curta Notechis scutatus occidentalis*	 Tiger snake

	Pseudonaja affinis affinia* Rhinocephalus gouldii Rhinocephalus nigriceps	Dugite
Mammals		
	Pseudocheirus occidentalis* Isoodon obesulus* Macropus fuliginosus* Hydromys chrysogaster	Western ringtail possum Southern brown bandicoot Western grey kangaroo Rakali, Water rat
Introduced species		
	Mus musculus* Rattus rattus Vulpes vulpes* Felis catus Oryctolagus cuniculus*	

*Evidence of presence found

Appendix 7. Aquatic invertebrates of Toby Inlet and associated wetlands

Aquatic invertebrates found in Toby Inlet during the two surveys by Streamtec (1997) and Tweedley et al. (2018).

Phylum / Order		Family / Species		Streamtec (1997)	Tweedley et al. (2018)
Nematoda			Nematoda sp.	✓	
Mollusca					
	Gastropoda	Ancylidae	Ferrissia petterdi	✓	
			(?) Fluviopupa sp.	✓	
		Planorbiidae	Physastra sp.	✓	
		Tateidae	Potamopyrgus sp.		✓
	Veneroida	Galeommatidae	Arthritica semen		✓
	Littorinimorpha	Pomatiopsidae	Coxiella striatula		✓
Annelida	Oligochaeta		Oligochaeta spp.	✓	
	Cnidaria			✓	
	Hydrozoa	Hydridae	Hydra sp.	✓	
	Arachnida			✓	
	Acarina		Hydracarina sp.	✓	
	Phyllodocida	Nereididae	Simplisetia aequisetis		✓
	Spionida	Spionidae	Pseudopolydora kempi		✓
	Polychaeta	Capitellidae	Capitella captitata		✓
	Polychaeta	Orbiniidae	Scoloplos normalis		✓
	Canalipalpata	Serpulidae	Ficopomatus enigmaticus		✓
Crustacea					
	Cladocera		Cladocera sp.	✓	
		Daphiidae	Daphinia sp.	✓	
	Ostracoda	Ilyocypridae	Ilyodromas sp.	✓	
			Ostracoda sp.	✓	
	Copepoda	Cyclopoida	Cyclopidae sp.	✓	
		Harpacticoida	Harpacticodae sp.	✓	

	Amphipoda	Gammaridae	Perthia sp.	✓	✓
			Amphipod sp.	✓	
		Aoridae	Grandidierella propodentata		✓
		Melitidae	Barnardomelita matilda		✓
	Decapoda	Palaemonidae	Palaemonetes australis	✓	
		Parastacidae	Cherax quinquecarinatus	✓	
	Isopoda	Armadillidae	Oniscidea sp.		✓
	Malacostraca	Chiltoniidae	Austrochiltonia subtenuis		✓
Crustacea	Mysida	Mysidae	Mysida sp. 1		✓
Insecta					
	Ephemeroptera	Leptophlebiidae	Bilbumena	✓	
		Baetidae	Baetis soror	✓	
		Caenidae	Tasmanocoenis tillyardi (Lestage)	✓	
	Odonata Zygoptera	Coenagriidae	Ischnura aurona	✓	
	Odonata Zygoptera	Coenagriidae	Odonata sp. 1		✓
	Odonata Zygoptera	Coenagriidae	Odonata spp.		✓
	Odonata	Aeshnidae	Austrolestes annulosus		✓
	Anisoptera	Corduliidae	Hemicordulia tau Selys	✓	
	Diptera	Simuliidae	Austrosimulium sp.	✓	
			Simulium ornatipes (Skuse)	✓	
		Ceratopogonidae	Ceratopogonidae sp. F	✓	
		Chironomidae		✓	
			Chironomidae sp. 1		✓
			Chironominae sp. 2		✓
			Chironominae spp.		✓
			Chironominae occidentalis		✓

			Chironominae alternans		✓
			Procladius sp.		✓
		Tipulidae	Tipulidae sp. A	✓	
			Tipulidae sp. B	✓	
			Tipulidae sp. X	✓	
			Unidentified spp.	✓	
		Empidadae	Empididae sp. B	✓	
			Unidentified spp.	✓	
		Culicidae	Culicidae sp. B	✓	✓
			Unidentified sp.	✓	
		Muscidae spp.	Unidentified sp.	✓	
		Stratiomyidae spp.	Unidentified sp.	✓	
		Syrphidae sp.		✓	
		Ephydridae	Ephydridae sp. X	✓	
	Lepidoptera		Lepidoptera sp. X	✓	
			Unidentified sp.	✓	
	Trichoptera	Ecnomidae	Ecnomus pansus/turgidus complex	✓	
			Oecetis sp.	✓	
			Notalina fulva	✓	
Insecta			Triplectides australis	✓	
			Oxyethira retracta	✓	
			Hellethira sp. C	✓	
		Leptoceridae	Notalina spira		✓
	Odonata	Aeshinidae	Aeshinidae sp.		✓
	Hemiptera	Notonectidae	Paranisops sp.	✓	
	Coleoptera		Carabidae sp.	✓	
		Dytiscidae	? Rhantus sp.	✓	
			Necterosoma sp. B	✓	
			Liodesus sp.	✓	
			? Megaporus sp.	✓	
			Platynectes decempunctatus	✓	

			Homeodyetes scutelaris	✓	
			Dytiscid sp. X	✓	
		Hydrophilidae	Hydrophilidae sp. A	✓	
			Hydrophilidae sp. X	✓	
			Hydrophilidae spp.	✓	
			Berosus approximans	✓	
			Berosus sp.	✓	
			Haliplidae sp.	✓	
		Lestidae	Austrolestes annulosus		✓

Appendix 8. Fish survey results 2017-2018

Fish species captured in nearshore and offshore waters of Toby Inlet before (November 2017) and after (March 2018) opening of the sand bar (Tweedley et al. 2018).

Species name	Common name	Estuarine use group*	November 2017	May 2018
Nearshore waters				
Leptatherina wallacei	Western Hardyhead	EF	✓	✓
Atherinosoma elongata	Elongate Hardyhead	E	✓	✓
Pseudogobius olorum	Bluespot Goby	EF	✓	✓
Gambusia holbrooki	Eastern Gambusia	FEO	2.36 ✓	✓
Gambusia holbrooki	Eastern Gambusia	EF	3.24 ✓	✓
Favonigobius lateralis	Southern Longfin Goby	EM	3.10 ✓	✓
Leptatherina presbyteroides	Silver Fish	EM		✓
Amniataba caudavittata	Yellowtail Grunter	E	✓	✓
Pelates octolineatus	Western Striped Grunter	MEO		✓
Mugil cephalus	Sea Mullet	MEO	✓	✓
Rhabdosargus sarba	Tarwhine	MEO	✓	✓
Galaxias occidentalis	Western Galaxias	FEO	✓	
Craterocephalus mugiloides	Spotted Hardyhead			✓
Sillago burrus	Western Trumpeter			✓
Pseudorhombus jenynsii	Smalltooth Flounder			✓
Atherinomorus vaigiensis	Common Hardyhead			✓
Acanthopagrus butcheri	Black Bream		✓	
Offshore waters		**EUFG**		
Mugil cephalus	Sea Mullet	MEO	✓	✓
Amniataba caudavittata	Yellowtail Grunter	E	✓	✓
Acanthopagrus butcheri	Black Bream	E	✓	✓
Aldrichetta forsteri	Yelloweye Mullet	MEO	✓	✓
Pelates octolineatus	Western Striped Grunter	MEO		✓
Rhabdosargus sarba	Tarwhine	MEO		✓
Arripis georgianus	Australian Herring	MEO		✓
Sillago schomburgkii	Yellowfin Whiting	MEO		✓
Pomatomus saltatrix	Tailor	MEO		✓
Gerres subfasciatus	Common Silverbiddy	MEO		✓
Sphyraena novaehollandiae	Snook	MS		✓
Pseudorhombus jenynsii	Smalltooth Flounder	MEO		✓
Nearshore waters				
Leptatherina wallacei		EF	✓	✓
Atherinosoma elongata		E	✓	✓
Pseudogobius olorum		EF	✓	✓
Gambusia holbrooki		FEO	✓	✓
Afurcagobius suppositus		EF	✓	✓
Favonigobius lateralis		EM	✓	✓
Leptatherina presbyteroides		EM		✓
Amniataba caudavittata		E	✓	✓
Pelates octolineatus		MEO		✓
Mugil cephalus		MEO	✓	✓

Rhabdosargus sarba		MEO	✓	✓
Galaxias occidentalis		FEO	✓	
Craterocephalus mugiloides				✓
Sillago burrus				✓
Pseudorhombus jenynsii				✓
Atherinomorus vaigiensis				✓
Acanthopagrus butcheri			✓	
Offshore waters		**EUFG**		
Mugil cephalus		MEO	✓	✓
Amniataba caudavittata		E	✓	✓
Acanthopagrus butcheri		E	✓	✓
Aldrichetta forsteri		MEO	✓	✓
Pelates octolineatus		MEO		✓
Rhabdosargus sarba		MEO		✓
Arripis georgianus		MEO		✓
Sillago schomburgkii		MEO		✓
Pomatomus saltatrix		MEO		✓
Gerres subfasciatus		MEO		✓
Sphyraena novaehollandiae		MS		✓
Pseudorhombus jenynsii		MEO		✓

* Estuarine usage functional groups: E, solely estuarine; MEO, marine estuarine-opportunist; MS, marine straggler; FEO, freshwater estuarine-opportunist; EF, estuarine & freshwater; E, solely estuarine; EM, estuarine & marine; MEO, marine estuarine-opportunist)

Appendix 9. Access Management Plan for Toby Inlet

Access Management Plan

Toby Inlet, Quindalup

JUNE 2018

Photo: Toby Inlet

Version control

Project number:	SW175			
Project file path:	SW175 Toby Inlet access planning			
Client:	City of Busselton			
Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
V1.1	19/06/18	Shane Priddle SW Environmental	Robyn Paice (City of Busselton)	Shane Priddle SW Environmental
V1.0	14/06/18	Shane Priddle SW Environmental	Robyn Paice (City of Busselton)	Shane Priddle SW Environmental

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Executive Summary

The City of Busselton ('the City') is preparing a Water Management Plan for Toby Inlet and required a conceptual plan for improving access and recreation facilities around Toby Inlet. The vision for the management plan is *"A healthy waterway and fringing vegetation that is actively managed, protected, valued and enjoyed by the community"*. One of the key management strategies is to improve access and facilities for community enjoyment that incorporate appropriate rehabilitation measures such as weed control, revegetation and erosion control.

This Access Management Plan has been prepared in consideration of the above and to meet the required scope of work. The study area includes the areas of Toby Inlet from the south western corner of the Palmers Estate downstream to the foot bridge crossing on Caves Road just east of the residential area of Quindalup. There was a preference to focus on the northern side of Toby Inlet.

This Access Management Plan for Toby Inlet categorised the Toby Inlet reserve into four access management precincts:

- **Vegetated areas (no tracks):** Areas of intact remnant native vegetation where there are no access tracks or only small foot tracks through vegetation. They often extend from the private property areas all the way to the foreshore vegetation or high water mark. Native vegetation has a high biodiversity conservation value and tracks should be generally avoided in these areas. Without clearing, these areas do not require any further attention.
- **Vegetated areas (existing tracks):** Areas consisting of intact remnant native vegetation with existing tracks. Tracks often link up sections of other precincts, such as street parking to foreshore parklands, or have been constructed as fire breaks. With the exception of the Geographe Bay foreshore path and footbridge east of Geographe Bay Road, most of these tracks are in need of maintenance or could be improved with either a 1.2m red hot mix seal in high traffic areas or at flood risk (e.g. foreshore areas) or compacted limestone along the firebreaks.
- **Parkland cleared (existing constructed tracks or maintained grassy areas):** Extensive sections of foreshore that have been cleared and are subject to ongoing maintenance (e.g. mowing). They are typically located in high use areas and would be ideal public parks. The construction of formal pathways following the contour of the inlet edge would encourage public use of these areas, are in close enough proximity to parking to be ideal locations for recreational infrastructure such as tables, barbeques, an outdoor class room or other passive recreation features. Additional parking may be required at these locations and should be considered in line with any infrastructure improvements. These existing high use areas are also typically the areas that are most degraded along the inlet banks. The loss of riparian vegetation has had numerous negative effects on the overall health of the inlet.
- **Private property access only:** Extended areas of foreshore reserve that are only able to be accessed by the adjacent private landowners. As these areas were not able to be accessed they were not surveyed in detail, nor is a pathway likely to be suitable.

Each precinct has unique opportunities to improve access and associated infrastructure (recreation facilities) around Toby Inlet. Site specific recommendations have been made in Appendix A including existing access, and recommended weed control, revegetation and erosion control. Additional opportunities including canoe access points, a boardwalk and clearing for new tracks was also discussed and could further enhance the existing Toby Inlet reserve.

A continuous pathway along the inlet could be achieved between Mc Dermott Street and Campion Way (approximately two kilometres) with the recommendations made in this report. Apart from the far western section around Palmers, Wilson Avenue and some isolated locations (e.g. Bloor Street) the other areas are inaccessible due to private property and/or vegetation.

1 Introduction

1.1 Background

The City of Busselton ('the City') is preparing a Water Management Plan for Toby Inlet and required a conceptual plan for improving access and recreation facilities around Toby Inlet.

The vision for the management plan is "*A healthy waterway and fringing vegetation that is actively managed, protected, valued and enjoyed by the community*".

One of the key management strategies is to improve access and facilities for community enjoyment that incorporate appropriate rehabilitation measures such as weed control, revegetation and erosion control.

Public consultation has shown very clearly that management should focus on encouraging passive recreation, and on improvements to existing access rather than increasing accessibility. There is also a perception that access pathways should act as barriers for protection of foreshore vegetation. The draft management actions for the management plan in relation to this are to develop and assess options for low-key access and recreation facilities in the area, such as:

- Install BBQ and seating at McBride Park or Wilson Avenue.
- Formalise carpark and access ways to horse beach, and improve signage.
- Provide some bird information and seating in appropriate, quiet areas.
- Investigate need for and location of bird hide.
- Enhance habitat for birds in connection with bird watching sites.
- Provide appropriate canoe-launching access at Mc Quade Park and address existing erosion.
- Improve existing walkways, and use these as reserve boundaries to protect fringing vegetation.
- Manage firebreak as bike access way.
- Determine requirements of additional parking in support of improved facilities.

This Conceptual Access Plan or 'Access Management Plan' has been prepared in consideration of the above and to meet the scope of work outlined below.

1.2 Scope of works

The study area includes the areas of Toby Inlet from the south western corner of the Palmers Estate downstream to the foot bridge crossing on Caves Road just east of the residential area of Quindalup. There was a preference to focus on the northern side of Toby Inlet. The study area is shown in Figure 1-1.

The scope of the consultation is to:

1. Review of 2017 vegetation survey as it relates to weed mapping and vegetation condition within the project area.
2. On-site meeting with City officer to discuss project.
3. Site survey to ground-truth existing pathways and access.
4. Recommendations for improvements to:
    - access pathways,

- canoe-launching area/s (provide ideas and examples for this),
- bird watching places,
- resting and observing areas.

5. Identify any requirements for weed control, erosion control and revegetation associated with these improvements. Note these will be generally high level, as in recommending areas that require these actions, rather than identifying site specific, prescriptive actions on how to undertake the actions.
6. Digitising of existing access, pathways, facilities, and recommendations.
7. Preparation of maps that clearly show existing features and recommendations.
8. A brief report that:
   - describes existing access/facilities,
   - outlines the recommendations and rationale,
   - links recommendations to maps.

Mapping layers will be provided as PDF in the report and as ESRI shapefiles.

Figure 1-1 Toby Inlet study area

2 Methods

This Access Management Plan was prepared based on desktop review and ground truthing.

2.1.1 Desktop review

Recent high resolution aerial photography (provided by the City of Busselton, 2018) was reviewed over the study area and potential tracks and lineal areas of vegetation disturbance digitised for follow up ground truthing. As many areas across the study area back onto private property with limited public access, this was useful to determine general land use and existing access opportunities.

A flora and vegetation report (Ecoedge 2017)[1] was also commissioned by the City for the broader study area. The flora and vegetation report results (vegetation types, condition and weeds and recommended revegetation locations) were reviewed, summarised in Section 3.2, and considered in the preparation of this Access Management Plan.

2.1.2 Ground truthing

The mapped areas were ground truthed by walking over the site on foot and investigating some inaccessible areas by drone (DJI Mavic Pro). A site meeting was carried out with Robyn Paice (Senior Environment Officer, the City) on 4th May and follow up fieldwork was carried out over two days by SW Environmental on 11th and 12th June 2018.

2.1.3 Limitations

Some areas were unable to be accessed due to a combination of the high water level at the time of the survey, heavy vegetation or tenure issues (private land uses or property restricting access). The high water level was due to the inlet not being open and an accumulation of water following seasonal rains. Some seasonally accessible low laying tracks may have been missed in this report. Whilst high water levels restricted access, it also provided insight as to where any access tracks and other recreational infrastructure may not be suitable or would be under water if constructed.

Heavy vegetation was not considered to be a constraint in terms of access. The management actions outlined a clear preference *to improvements to existing access rather than increasing accessibility* and *protection of foreshore vegetation*. These areas were therefore not considered further for access.

Private property backs onto the Toby Inlet along extended sections, with fencing, clearing and retained remnant native vegetation extending right to the Inlet itself (often within the reserve). For the most part, other than direct access from an adjacent house, there are no existing pathways along these sections nor would future proposed paths likely to have the support of the adjacent landowner.

The underwater, vegetated and restricted access locations throughout the study area are generally not considered appropriate for pathways in line with the management plan actions and scope of work.

[1] Ecoedge (2017) Report of a Flora and Vegetation survey at Toby Inlet. Unpublished report to the City of Busselton.

3 Results

3.1 Existing environment and tenure

The 47 ha study area is located along the Toby Inlet, a 118 ha low energy coastal lagoon that meanders from the eastern edge of the Dunsborough Township east to the mouth at Geographe Bay. It is formed from the flooding and drainage of low laying sumplands south of Caves Road. The study area comprises a combination of Crown Land and reserves vested in or managed by the City.

The residential locality of Quindalup is located between Toby Inlet and the Geographe Bay foreshore. It is long and narrow in extent, well less than 100m wide at some locations, with many of the residential properties backing directly onto the reserves associated with the inlet. Historic pressures from with local development and secondary uses relating to the recreational opportunities offered by the inlet (access, water sports, fishing, picnics, water craft launching etc) have created additional pressures on the inlet, such as impacts to foreshore riparian vegetation and bank stability. A general background on Toby Inlet and land uses will be addressed in more detail in the Water Management Plan.

3.2 Vegetation (including weeds)

Ecoedge (2017) carried out a flora and vegetation report which is useful in identifying

- areas of intact vegetation or areas of conservation significance that should be avoided in terms of access,
- areas that are already cleared or degraded,
- areas of weeds that will require management.

A summary of the flora and vegetation report (Ecoedge 2017) is provided below. One hundred and four vascular plant taxa were recorded for the survey area, almost 50% were naturalised, planted, or non-locally native species. The high proportion of non-native species reflects the long disturbance history of much of the vegetation, the degree of urbanisation, and the narrow width of much of the inlet foreshore reserves.

Of the non-native species, 14 were considered potential or actual environmentally significant weeds. Two groups of weeds ("mixed agricultural weeds" and "mixed garden escapees") were recorded; those that have probably been present in the native vegetation for 100 years or more (e.g. Bridal Creeper, Blue periwinkle, Arum Lily, Onion Weed and Hare's Tail Grass) and are more or less naturalised, and those that are more recent garden escapees such as *Dimorphotheca ecklonis* (Cape Daisy) and *D. juncundum* (African Daisy) an *Lilium* spp. which are seen invading the surrounding bushland from gardens established on Crown land adjacent to the inlet. Weeds are shown in Appendix A where they should be considered in context of access management.

No State or federal listed threatened flora, Priority flora or other flora of conservation significance were found. Several Environmentally Sensitive Areas (ESAs) have been designated within the survey area associated with the Toby Inlet, which is classified as a Conservation Category wetland.

Nine native vegetation units were recognised, six of them part of the Vasse Complex (Wetland and Estuarine Fringe Vegetation units) and three of them in the Quindalup Complex (Beach and Dune Vegetation units). Four other non-native or planted vegetation units were also mapped (**Ammophila arenaria – Spinifex hirsutus* grassland, Plantation (Amenity plantings), Heavily Disturbed Area (includes lawn areas with scattered *A. flexuosa* or *Melaleuca* spp.), and Water (Toby Inlet)).

About 35.5 ha of Quindalup Complex vegetation was mapped in the survey area, most of it in Very Good or Excellent condition. Two of these vegetation units fit the diagnostic criteria of the Federally-listed Threatened ecological community "Subtropical and Temperate Coastal Saltmarsh", which is also listed as a Priority 3 ecological community at the State level. In particular, *Salicornia quinqueflora* low shrubland and *Juncus kraussii-Ficinia nodosa* closed sedgeland fit within the Coastal Saltmarsh TEC criteria. There was 5.7 ha of Coastal Saltmarsh TEC (comprised of the above two vegetation units) in the survey area, most of it in Good or Very Good condition.

Just over 40% of the remnant vegetation within the survey area was classified as "Very Good" or "Excellent" condition. These areas were mainly in the eastern part of the survey area on Crown reserves (A class reserve No. 46 and Sussex lots 4748 and 4857). Almost all of the remnant native vegetation on privately owned land south of Caves Road was classed as "Degraded".

A regional ecological linkage runs through the survey area for much of its length (Molloy et al 2009)[2]. As a result of the location of this linkage, survey area vegetation has been assigned proximity rating values of 1a, 1b and 1c, which are the three highest ratings.

Ecoedge (2017) identified areas that would benefit from revegetation, associated with where the Toby Inlet crosses Caves Road. These are shown in Appendix A. They are broad scale (only areas over 1500 m^2 are mapped) and best adopted separately to this Access Management Plan. Finer scale recommendations are addressed further in this document (Sections 3.3, 3.4 and Appendix A).

In addition to the conservation values highlighted by Ecoedge (2017) several threatened fauna may also utilise the site for habitat and as an important connection along the inlet foreshore, including the Critically Endangered Western Ringtail Possum (WRP).

3.3 Existing access, infrastructure and opportunities

Throughout the Toby Inlet reserve, existing access types are generally reflective of current foreshore usage patterns and demand. Built up areas typically have more frequent visitors, a higher need for formalised access and require management intervention the most. Long term trends of population increase are likely to result in higher foreshore usage and access requirements. This has been considered in relation to opportunities in this Plan.

3.3.1 Existing access and opportunities

There are numerous existing pathways from formal vehicular tracks and firebreaks, concrete paths, cleared and maintained parkland areas to informal access through native vegetation. Considering access types the study area can generally be broken up into several management precincts:

- Vegetated areas (no tracks),
- Vegetated areas (existing tracks),
- Parkland cleared (existing constructed tracks or maintained grassy areas),
- Private property access only.

These are mapped in Figure 3-1 (detailed in Appendix A) and are described below. Additional location specific recommendations, such as track closures and revegetation opportunities are also made in the Appendix.

[2] Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. (2009) *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

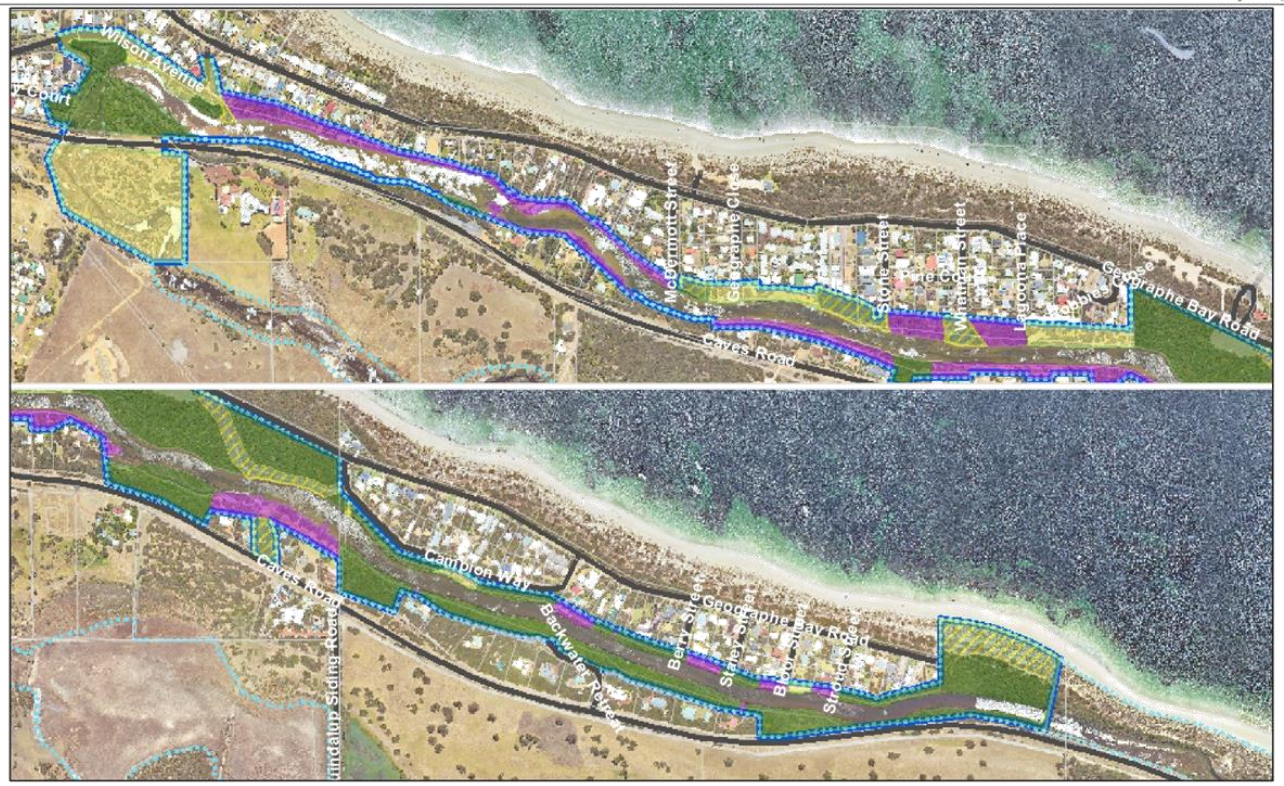


Figure 3-1 Toby Inlet access management precincts

Vegetated areas (no tracks)

These areas consist of intact remnant native vegetation where there are no access tracks or only small illegal foot tracks through vegetation. They often extend from the private property areas all the way to the foreshore vegetation or high water mark. Native vegetation has a high biodiversity conservation value and tracks should be generally avoided in these areas. For the most part these areas do not require any further attention other than small illegal foot tracks.

Vegetated areas (existing tracks)

These areas consist of intact remnant native vegetation with existing tracks. Tracks often link up sections of other precincts, such as street parking to foreshore parklands, or have been constructed as fire breaks. Typical examples include

- the 1.2m sealed access to the foreshore from Geographe Close and Stone Street (Maps 5 and 6),
- the 3m wide emergency access to the foreshore from Lagoona Place (Map 6),
- the degraded 1m sealed access to the foreshore from Robbies Close (Map 7),
- the fire trail linking the foreshore to Geographe Bay Road east of Robbies Close (Map 7),
- the unsealed 3m wide firebreak from the Dunsborough Boat Club overflow carpark to Campion Way (Map 7 and 8),
- the existing Geographe Bay foreshore walk and footbridge east of Geographe Bay Road (Map 12).

With the exception of the Geographe Bay foreshore walk and footbridge east of Geographe Bay Road, most of these tracks are in need of maintenance or could be improved with either a 1.2m (or City standard) red hot mix seal in the high traffic areas or those at risk of flooding (e.g. foreshore areas), or compacted limestone along the firebreaks. Formalising tracks would encourage use and contain potential impacts that might otherwise occur (e.g. minimise trampling along the edges). Some existing areas need to be repaired (e.g. existing concrete path south of Geographe Close, shown in Figure 3-2). Location specific management recommendations are provided in Appendix A.

Figure 3-2 Existing path south of Geographe Close needing repair.

Figure 3-3 Existing path near Stone Street requiring maintenance.

Figure 3-4 Emergency access off Lagoona Place that could be improved with new hot mix.

Figure 3-5 Firebreak from the Boat Club overflow carpark to Campion Way that could be formalised with compacted limestone.

Parkland cleared (existing constructed tracks or maintained grassy areas)

These include extensive sections of foreshore that have been cleared and are subject to ongoing maintenance (e.g. mowing). They are typically located in high use areas and would be ideal public parks. Examples include

- the parkland at Wilson Avenue (currently no pathway),
- Campion Way (Mc Quade Park) (currently no pathway),
- the area west of Palmers Estate (low use) (grass pathways / firebreaks),
- the resort areas off Lagoon Place and south of Robbies Close (existing 1.2m pathway), and
- the grassy area at Bloor Street (currently no pathway).

The construction of formal pathways following the contour of the inlet edge would encourage public use of these areas, are in close enough proximity to parking to be ideal locations for recreational infrastructure such as tables, barbeques, an outdoor class room or other passive recreation features. Pathways can also provide boundaries for protection of foreshore vegetation. Additional parking may be required at these locations and should be considered in line with any infrastructure improvements.

These existing high use areas are also typically the areas that are most degraded along the inlet banks. The loss of riparian vegetation has had numerous negative effects on the overall health of the inlet, including but not limited to

- Loss of bio filter mechanism (plants) for sediments and pollutants entering the inlet from upslope,
- Increased erosion (the areas with no vegetation stabilising the bank are those with the most erosion issues),
- Loss of habitat connectivity (particularly important for fauna such as WRP).

The areas between the existing / proposed tracks should be revegetated, with occasional trees but low sedges such as coastal sword-sedge (*Lepidosperma gladiatum*) or local provenance wetland species. It may be important to maintain a balance between the existing visual amenity of the inlet as an asset, given that some areas have already been cleared.

Figure 3-6 Caves Road, Palmers Estate to the left and the section of Toby Inlet outlined within the study area in the mid ground. Note although flooded in this picture there are extensive mowed grassy walkways that could be formalised with crushed limestone.

Figure 3-7 Maintained parkland at Wilson Avenue where a defined pathway would define the reserve boundary and protect fringing vegetation.

Figure 3-8 Example of erosion at Mc Quade Park (Campion Way) due to loss of stabilising foreshore vegetation.

Figure 3-9 Example of erosion at Mc Quade Park (Campion Way) due to loss of stabilising foreshore vegetation.

Figure 3-10 Cleared area off Bloor Street.

Figure 3-11 Cleared area off Bloor Street showing clearing from adjacent landowner and fencing to the water edge.

Private property access only

There are extended areas of foreshore reserve that are only able to be accessed by the private landowners that back onto it. This is either due to

- Inappropriate management by adjacent landowners (e.g. Figure 4-10 above) where through fencing or personal use of the reserve, public access is difficult or discouraged,
- Restricted access due to terrain, narrow foreshore reserve, or sections of intact vegetation or other obstacles (such as high water level).

As these areas were not able to be accessed they were not surveyed in detail, nor is a pathway likely to be suitable.

These areas will be a challenge to the City in terms of ensuring appropriate foreshore management and will likely be addressed in the broader Water Management Plan. There are several sections that could be used by the public where a landowner(s) could be contacted, but in isolation and without connectivity to other pathways, they are limited in what they can offer in this Plan.

Figure 3-12 Example of restricted access and private property adjacent to the reserve.

3.3.1 Additional existing infrastructure and opportunities

Existing

Additional existing recreational infrastructure noted during fieldwork included passive infrastructure elements that may improve the recreational experience associated with the access, or that may encourage access by enriching the foreshore environment.

Existing additional infrastructure is very limited along the foreshore, to the point of being neglected. This is probably due to low use historically coupled with low demand for new infrastructure. Existing infrastructure observed in relation to the foreshore access, included (refer to Appendix A for waypoint locations):

- Bird hide (WP 1)[3] (Map 1)
- Foot bridge (WP 2)[3] (Map 1)
- Bench seat (WP 3) (Map 3)
- Seat (WP 4) (Map 6)
- Water taps (WP 5, 6, 7) (Map 9)
- Derelict table (WP 8) (Map 9)
- Bench seat (WP 9) (Map 9)

These are shown in the photos below. There are a number of pontoons and other informal structure private property structures that may require inspection and assessment by the City as to whether they should be removed due to a public liability risk (risk delegation signage might be more appropriate than removal).

[3] Note these are outside or on the edge of the study area or within other insecure tenure.

Figure 3-13 Bird hide (WP 1)

Figure 3-14 Foot bridge (WP 2)

Figure 3-15 Bench seat (WP 3)

Figure 3-16 Seat (WP 4)

Figure 3-17 Bench seat (WP 9)

Figure 3-18 Derelict table (WP 8)

Opportunities

There are opportunities for the development of new low key infrastructure to enhance the foreshore and encourage public access. Examples include (see Appendix A):

- Wilson Avenue: Barbeque or picnic table within the parkland at Wilson Avenue.

- WP 10: Bird hide (easy access, good cover and existing bird attracting snags within the inlet. Drawback would be possible low water level during summer months).
- WP 11: Bench seat or bird hide (easy access, good cover and though a lack of existing snags within the inlet and possible low water level during summer months).
- Resort area between Geographe Close and Stone Street Bench: add bench seat.
- End of Stone Street (WP 12): Add compacted ramp for canoe access or fishing, otherwise close off and revegetate.
- Parkland area off Lagoona Place (WP 13): Add seat / table in the park areas, and consider fishing platform (stabilised bank) along a small section of degraded bank.
- Track off Campion Way (WP 14): Add compacted ramp for canoe access or fishing, otherwise close off and revegetate.
- Mc Quade Park (Campion Way): Barbeque or picnic table within the parkland. Consider fishing platform (stabilised bank) along a small section of degraded bank. Formalise a canoe launching area in the eastern edge of the park (where there is existing scouring of the bank). Remove bollards and add parking bays at the eastern end of the park.

Foreshore access from public roads are typically hard to find and should be clearly sign posted. Access points along the cul de sacs would benefit most from this:

- Mc Dermott Street
- Geographe Close
- Stone Street
- Whatman Street
- Lagoona Place
- Bloor Street

3.4 Other opportunities

Other opportunities for further consideration include canoe access points, a boardwalk around areas of limited access, and clearing for the construction of new tracks.

3.4.1 Canoe access points

Formal canoe (or equivalent such as stand up paddleboard) access points are required at different locations along the Inlet. Canoes appear to be being launched at several locations including Mc Quade Park (within the eroded area at the eastern edge of the park), Stone Street and off Campion Way.

Given the demand for use at these locations it is recommended that all of these locations are formalised. A formal entry point should consider the following:

- Close access to parking,
- Located downstream enough so that water levels are adequate for most of the year,
- Ensure the natural bank is stabilised,
- Ensure construction materials will withstand periodic inundation,
- Include appropriate signage,
- Alternative use as a fishing platform.

Figure 3-19 Examples of stepped retaining walls that could be enlarged for canoe access, or as a fishing platforms in degraded areas.

Figure 3-20 Example of graded access to the water mark. Note that retaining walls would still be required at the bank cutting. Source: https://www.lcfpd.org/launches/

3.4.2 Boardwalk

The construction of timber boardwalks, whilst generally out of the scope of this consultation, should be considered in areas where there is

- Dense vegetation or private property along the foreshore limiting foreshore access,
- High scenic quality,
- Tracks would contribute to connecting other access areas and improve the overall value of the foreshore,
- Could be also used as a fishing platform.

These are low key features, relatively cheap to build, with low construction impacts if constructed during summer low water level months (with little or no clearing required). They have been adopted with high success by other local governments in high value sensitive coastal lake locations such as Bottom Lake, Merimbula (Bega Valley Shire Council) (see Figure 3-21) and Narooma Foreshore (Eurobodalla Shire Council). A starting point for the installation of a boardwalk might be the 100m and 70m private property sections between Stone Street and Lagoona Place, which would then enable a continuous pathway of about two kilometres long.

Figure 3-21 Boardwalk examples around Bottom Lake, Merimbula

3.4.3 Clearing

The clearing of native vegetation for the purposes of walking tracks is generally exempt from requiring a clearing permit under the walking tracks exemption (*Regulation 5, Item 13* of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*). This exemption however does not apply in Environmentally Sensitive Areas (ESAs) such as the mapped Conservation Category wetland section of Toby Inlet. Clearing that is not exempt requires a clearing permit in accordance with the *Environmental Protection Act 1986*.

Whilst there is a general preference to avoid native vegetation in line with the Toby Inlet draft management actions, low impact clearing could be carried out at specific locations

- To maintain continuity and connectivity of the existing track network, thereby improving the overall value and usage of the asset,
- Control impacts to native vegetation, e.g. provide a formal, controlled access to the foreshore where existing access has been informally achieved. In some cases if there has been informal access then there may be a demand to access the foreshore at that location.

An example would be the construction of a pathway along Campion Way road reserve linking Mc Quade Park to the east to the existing pathway off Campion Way to the Boat Ramp parking lot. Low impact clearing of sword sedge would be required.

Figure 3-22 Clearing required for a pathway along the southern Campion Way roadside (see red line).

4 Conclusions

Toby Inlet reserve was categorised into four access management precincts:

- Vegetated areas (no tracks)
- Vegetated areas (existing tracks)
- Parkland cleared (existing constructed tracks or maintained grassy areas)
- Private property access only

Each type has unique opportunities to improve access and associated infrastructure (recreation facilities) around Toby Inlet. For at least some locations the recommendations associated with these opportunities could be implemented relatively easily to meet the Water Management Plan vision of "*A healthy waterway and fringing vegetation that is actively managed, protected, valued and enjoyed by the community*".

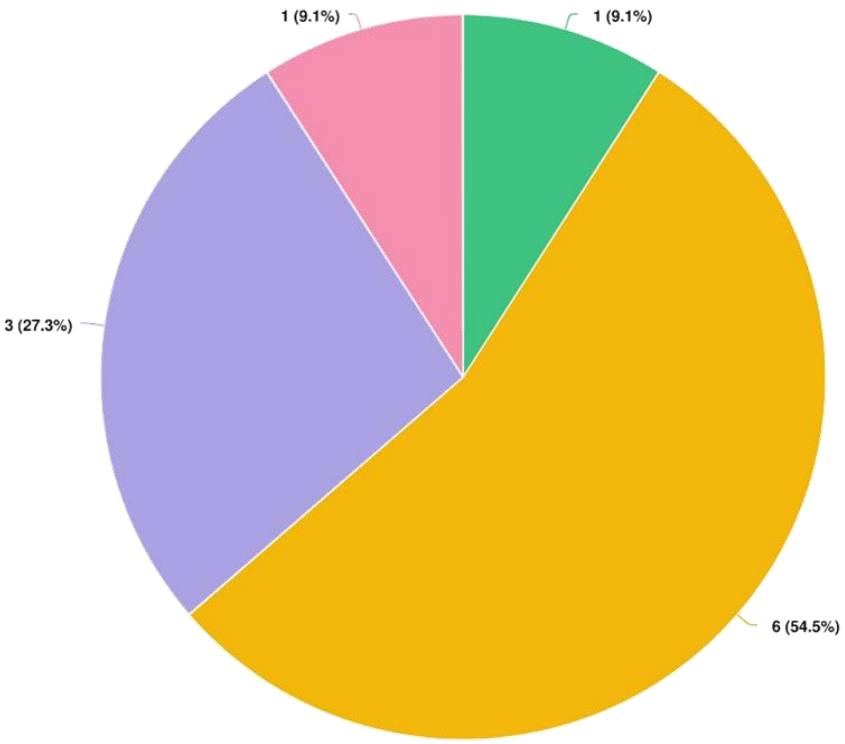
A continuous pathway along the inlet could be achieved between Mc Dermott Street and Campion Way (approximately two kilometres). Apart from the far western section around Palmers, Wilson Avenue and some isolated locations (e.g. Bloor Street) the other areas are inaccessible due to provide property and/or vegetation. Site specific recommendations have been made in the Appendix including existing access, recommended weed control, revegetation and erosion control. Additional opportunities including canoe access points, a boardwalk and clearing for new tracks was also discussed and could further enhance the existing Toby Inlet reserve.

Appendix A Access Management Maps (2018)


Survey Report
01 December 2018 - 28 February 2019
Lower Vasse River - Waterway Management Plan Survey
PROJECT: Waterway Management Plans
Your Say Busselton
engagement hq
by Bang the Table

Lower Vasse River - Waterway Management Plan Survey : Survey Report for 01 December 2018 to 28 February 2019

Q1 **Do you feel that the Information about the Lower Vasse River and its management issues is sufficient and accurate?**



Question options

Strongly Agree Agree Neutral Disagree

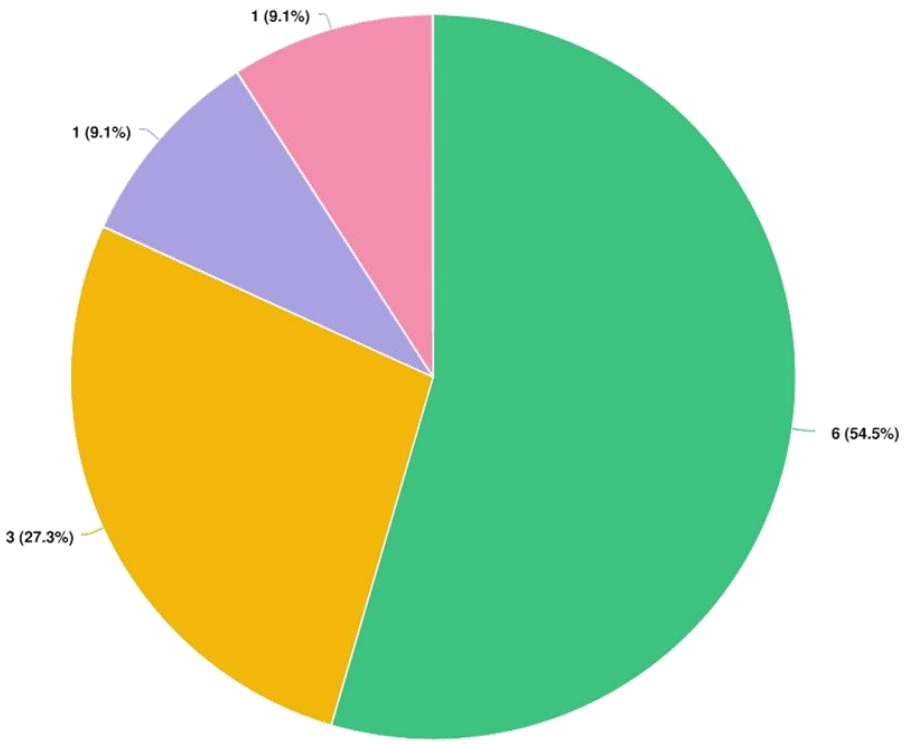
(11 responses, 0 skipped)

Q2 Do you have any further comments on the information available?

stuart anderson 1/21/2019 04:08 PM	The strategy is lacking in fixing the problem for now. There needs to be at least three direct treatment methods to remove the algae at present.
JGBUSSELL 2/05/2019 11:16 PM	Pretty accurate although there is no mention the natural ground water stream that occurs under the silt.
Chris Banks 2/08/2019 05:11 PM	Don't want to see progress be held up by politics
joanna taylor 2/09/2019 08:24 PM	No
swesley 2/19/2019 11:52 AM	the report could cover off on why it would not be effective to filter the water in some way. Mobile activated carbon filter? Some peole think that part of the solution maybe to simply filter the algae and thereby remove the phosphates which is not true.
BaDRA 2/24/2019 10:46 PM	The solution to our rivers health woes is to clean the river and dredge a defined water course, constructing levies where required and then constantly allow natural flushing of the river with most of the fr

Optional question (6 responses, 5 skipped)

Q3 Overall, do you believe the list of management strategies and actions are suitable to address management issues?

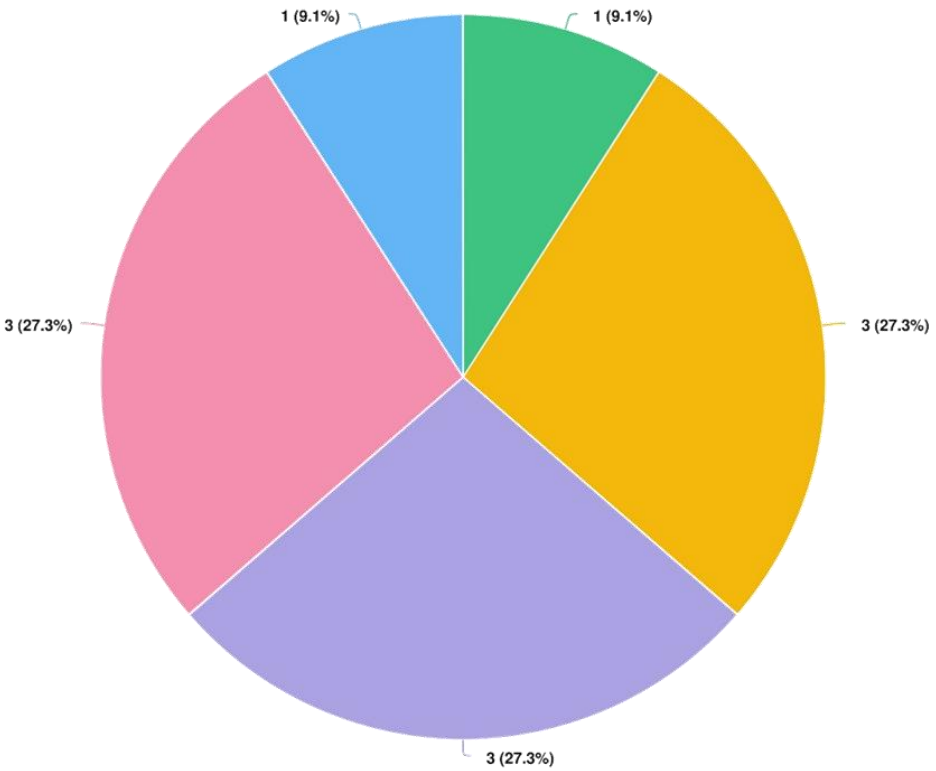


Question options

Agree Neutral Disagree Strongly Disagree

(11 responses, 0 skipped)

Q4 Do you feel that the plan provides clarity in how the waterway will be managed and who is responsible?

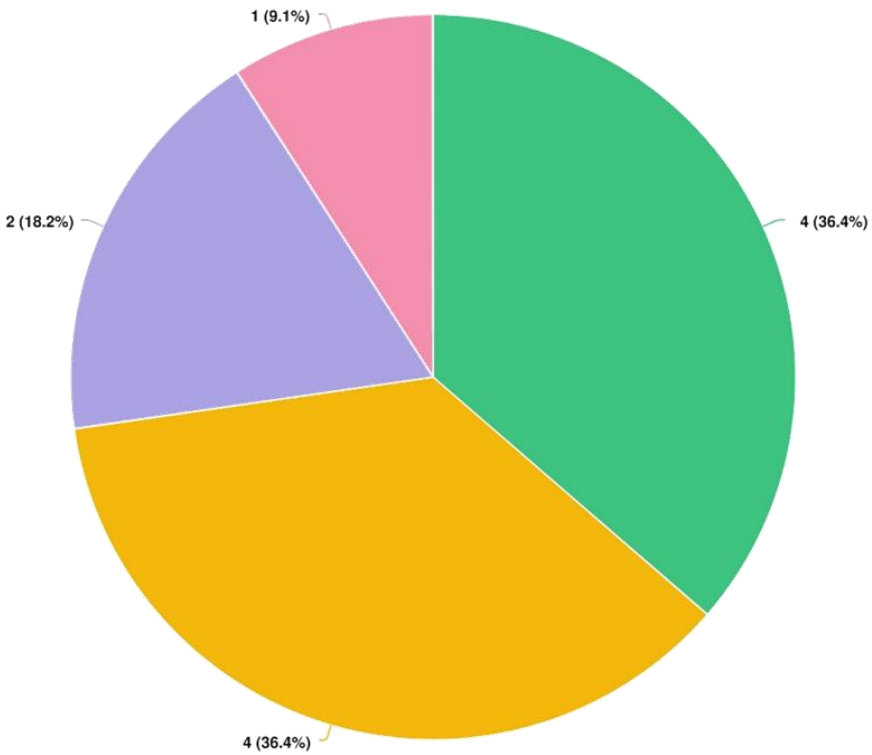


Question options

Strongly Agree Agree Neutral Disagree Strongly Disagree

(11 responses, 0 skipped)

Q5 Do you believe the City of Busselton should be the lead management agency for the waterway?

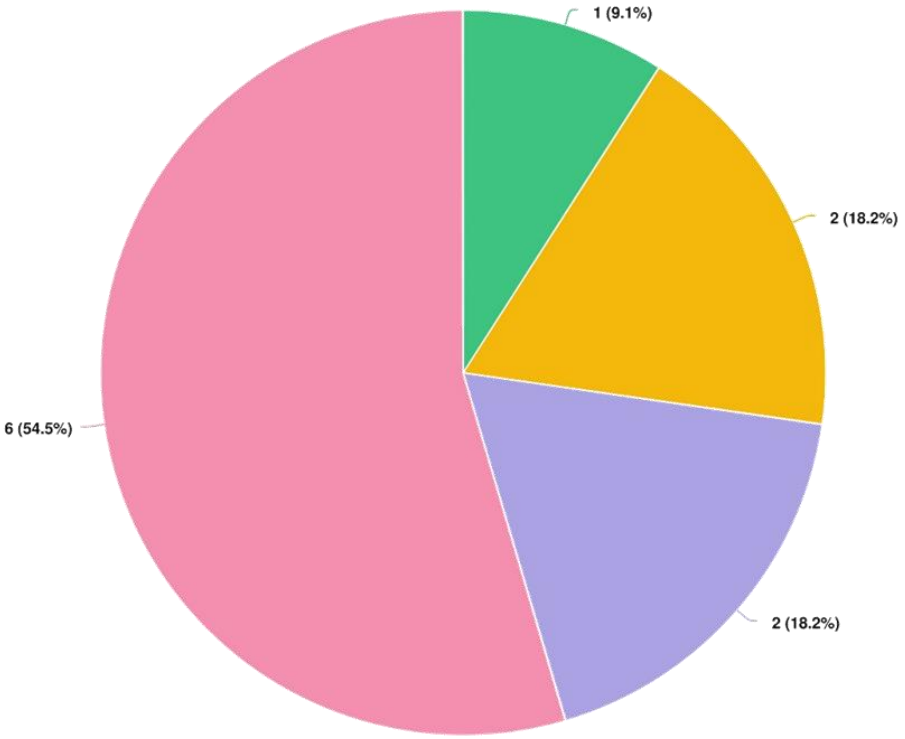


Question options

Strongly Agree Agree Neutral Disagree

(11 responses, 0 skipped)

Q6 Living Streams approach to managing the Lower Vasse River - Living Streams is a management strategy that would see substantial restoration of the Lower Vasse River to create a more diverse ecosystem and establish conditions less favourable to algal...

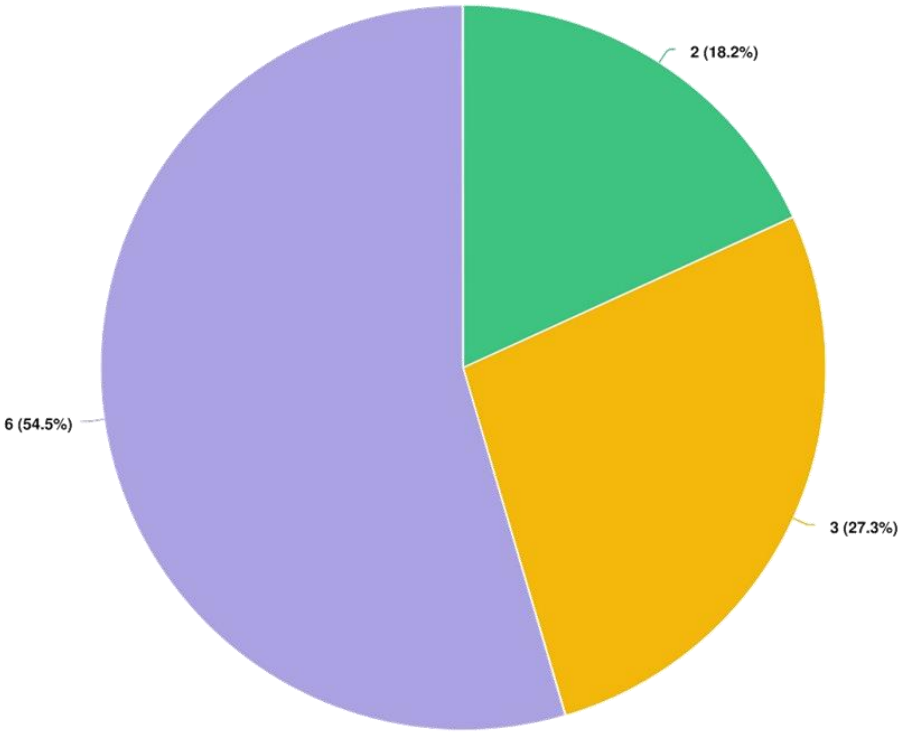


Question options

No change at all
Sediment removal only
Minor physical change and additional planting
Extensive changes to river form to create diverse habitats including seasonal drying between summer pools

(11 responses, 0 skipped)

Q7 What is your view on future funding for the management actions?

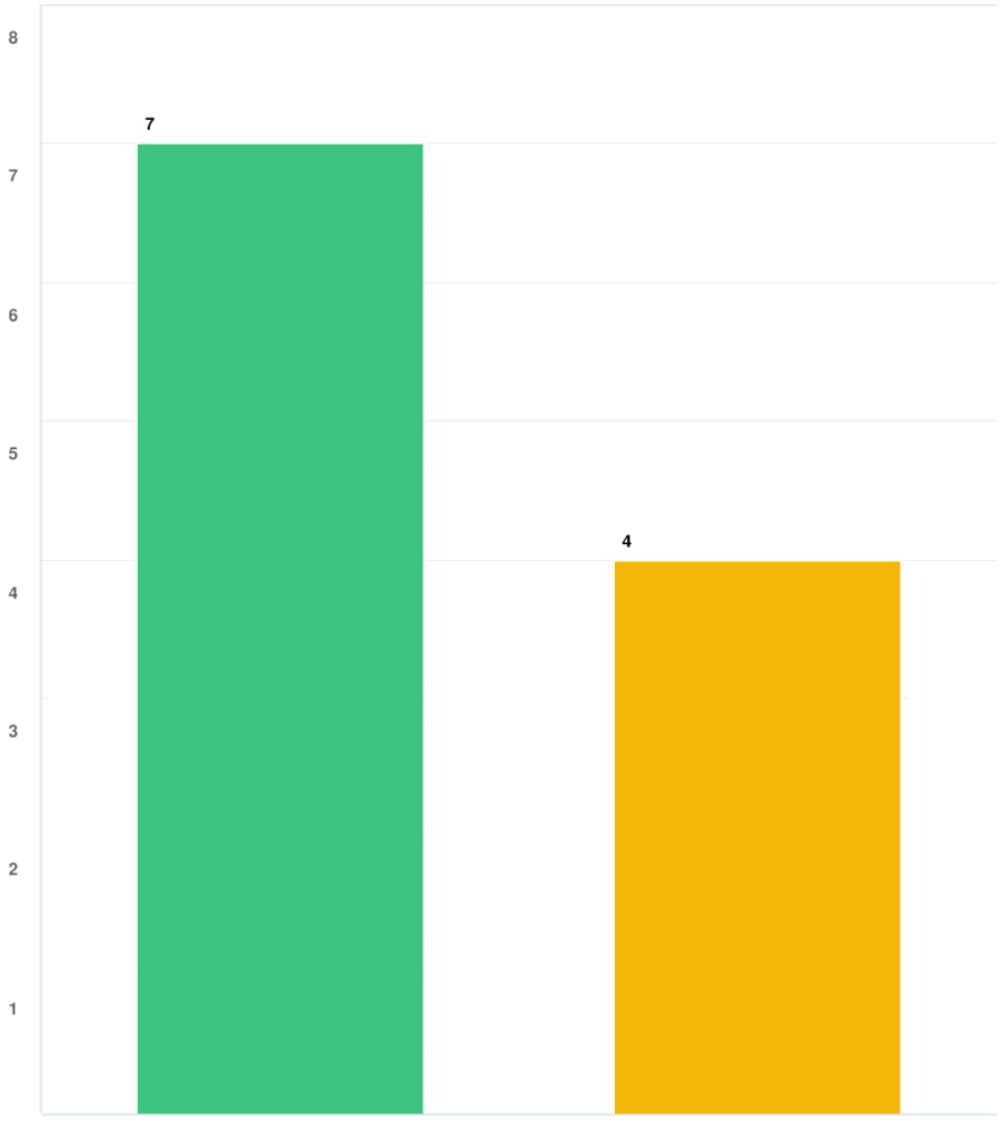


Question options

- Actions should be delivered to the extent possible with existing funding
- Additional grant funding should be sought to implement priority actions
- The City should increase investment significantly and use this to seek more external funding

(11 responses, 0 skipped)

Q8 Would you like to provide further comment on each of the management strategies? (These questions are OPTIONAL)

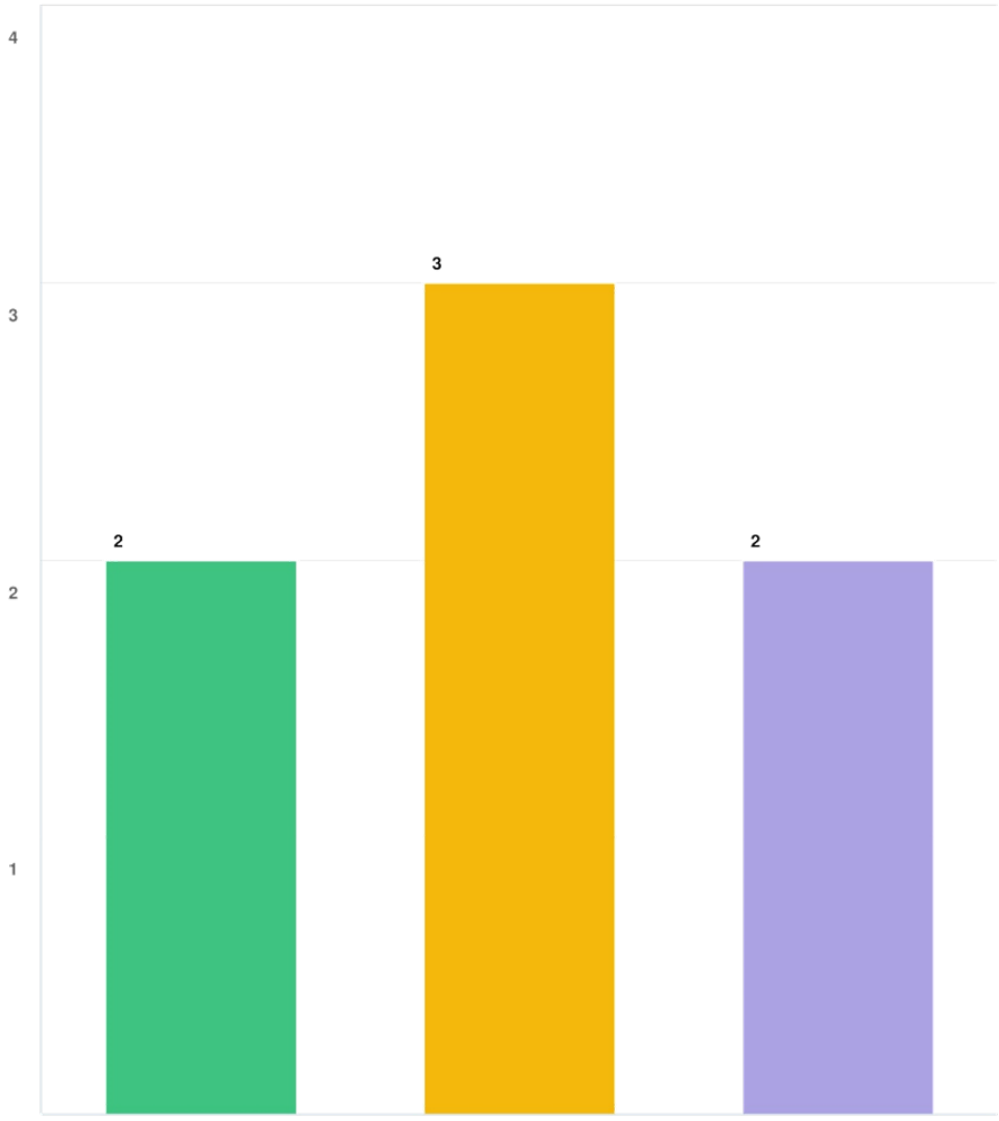


Question options

Yes No

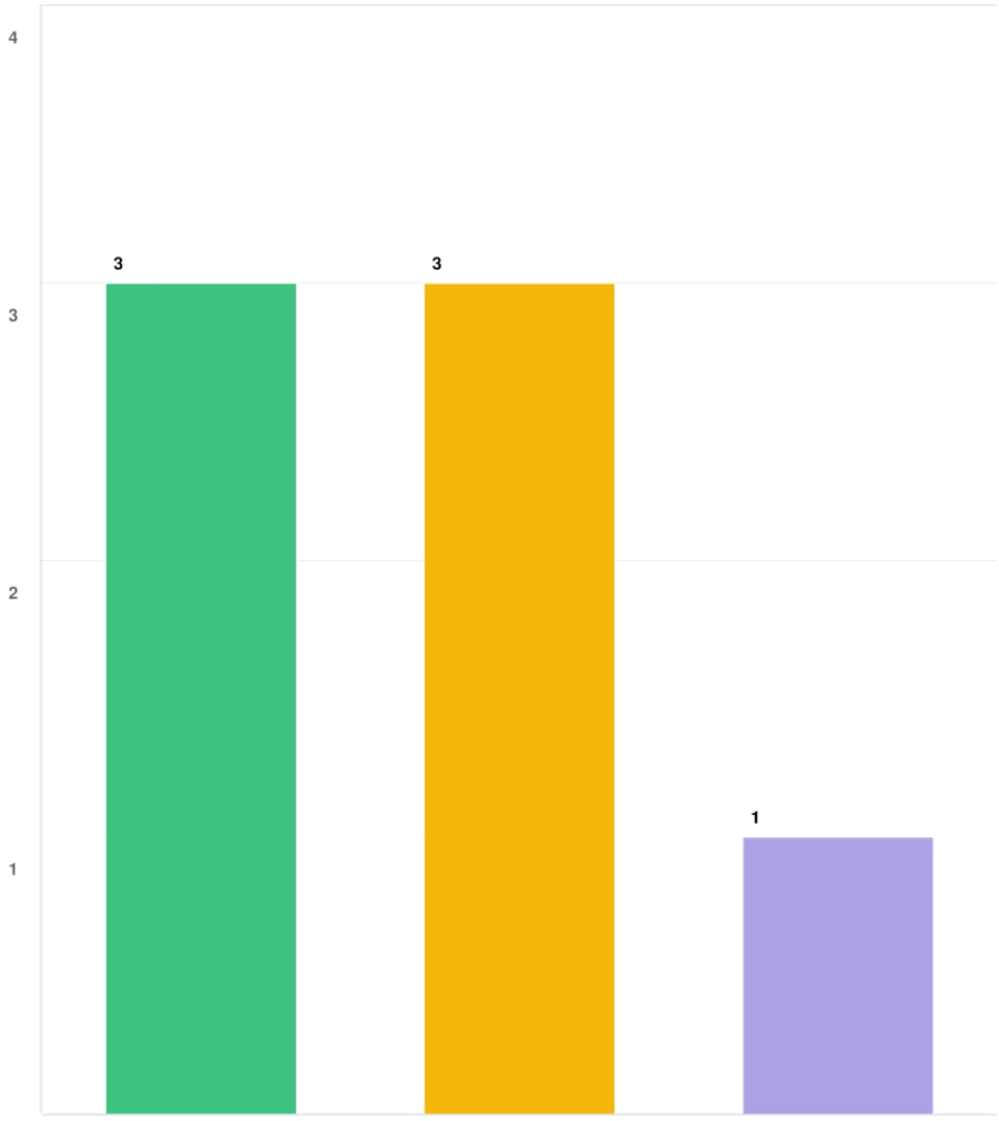
(11 responses, 0 skipped)

Q9 Living Streams Approach - Do you think the recommended actions will contribute to the vision and management objectives?



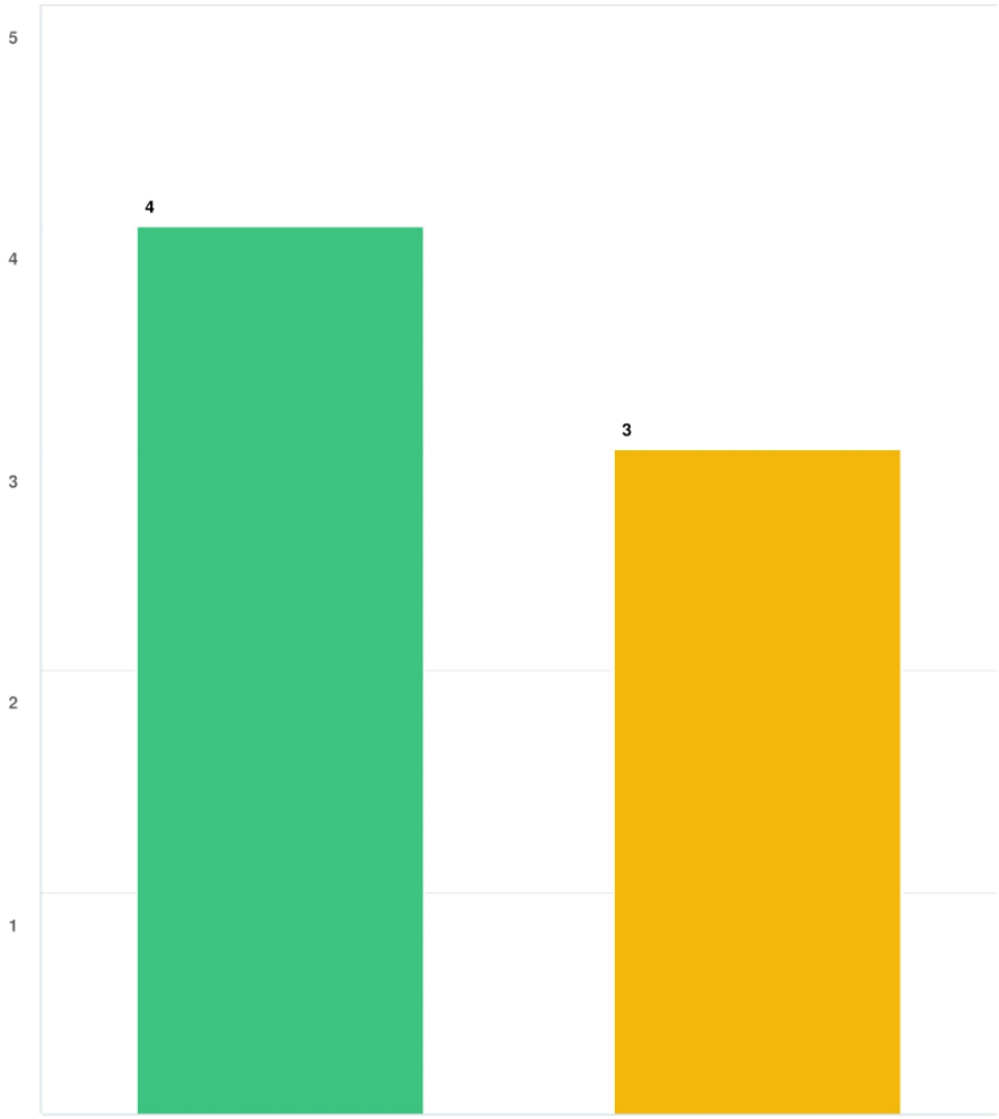
Optional question (7 responses, 4 skipped)

Q10 Protecting water quality from urban sources - Do you think the recommended actions will contribute to the vision and management objectives?



Optional question (7 responses, 4 skipped)

Q11 **Reducing nutrient inputs from the rural catchment - Do you think the recommended actions will contribute to the vision and management objectives?**

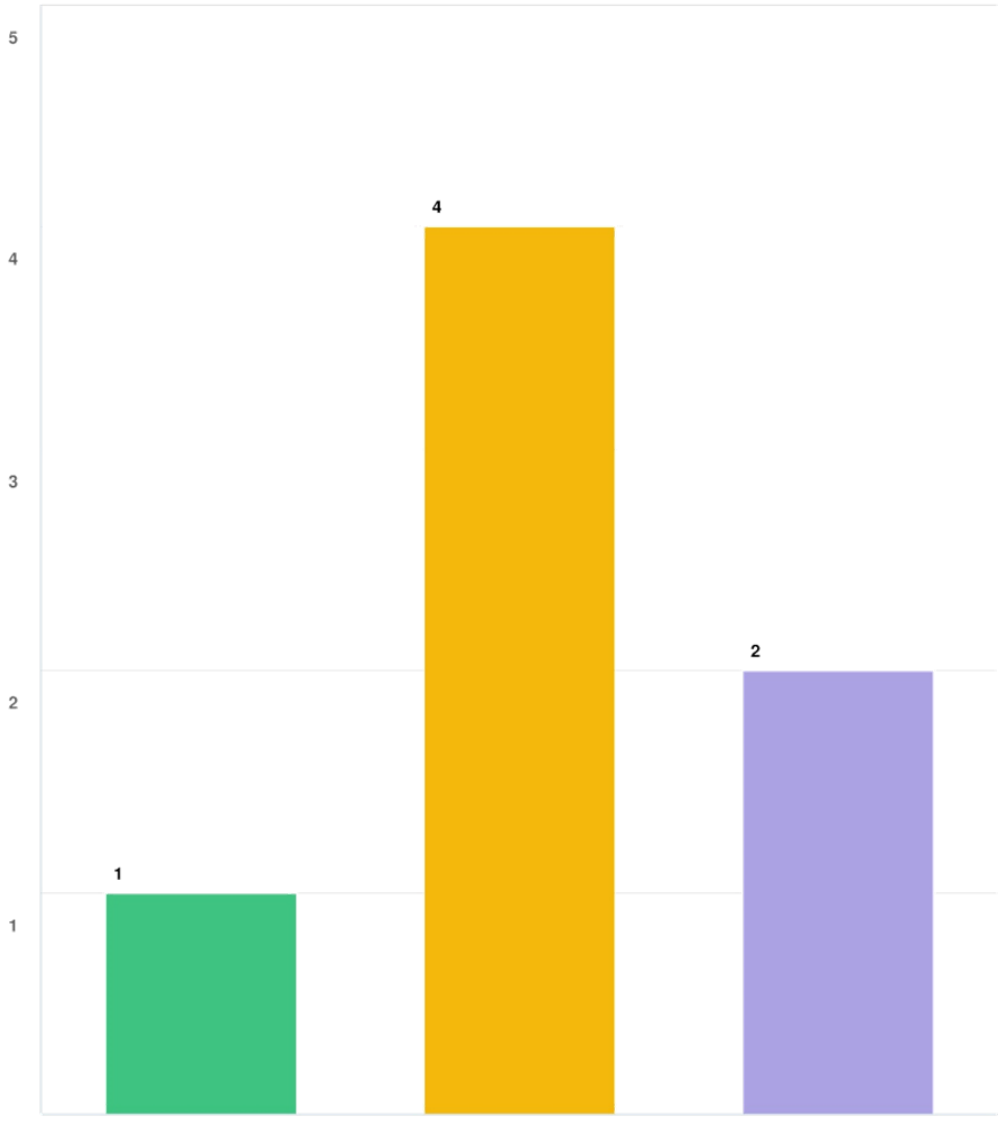


Question options

Significantly Somewhat

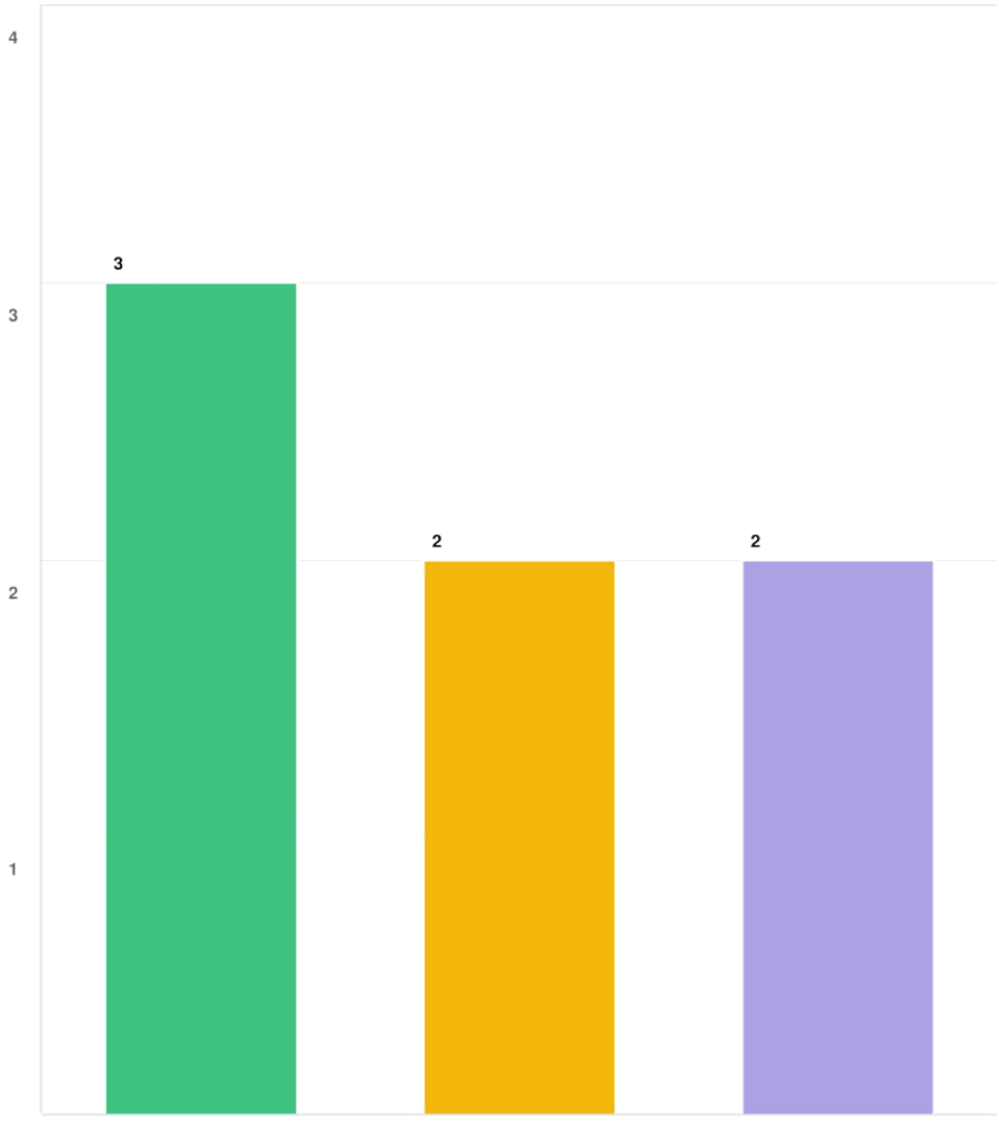
Optional question (7 responses, 4 skipped)

Q12 **Water treatment - Do you think the recommended actions will contribute to the vision and management objectives?**



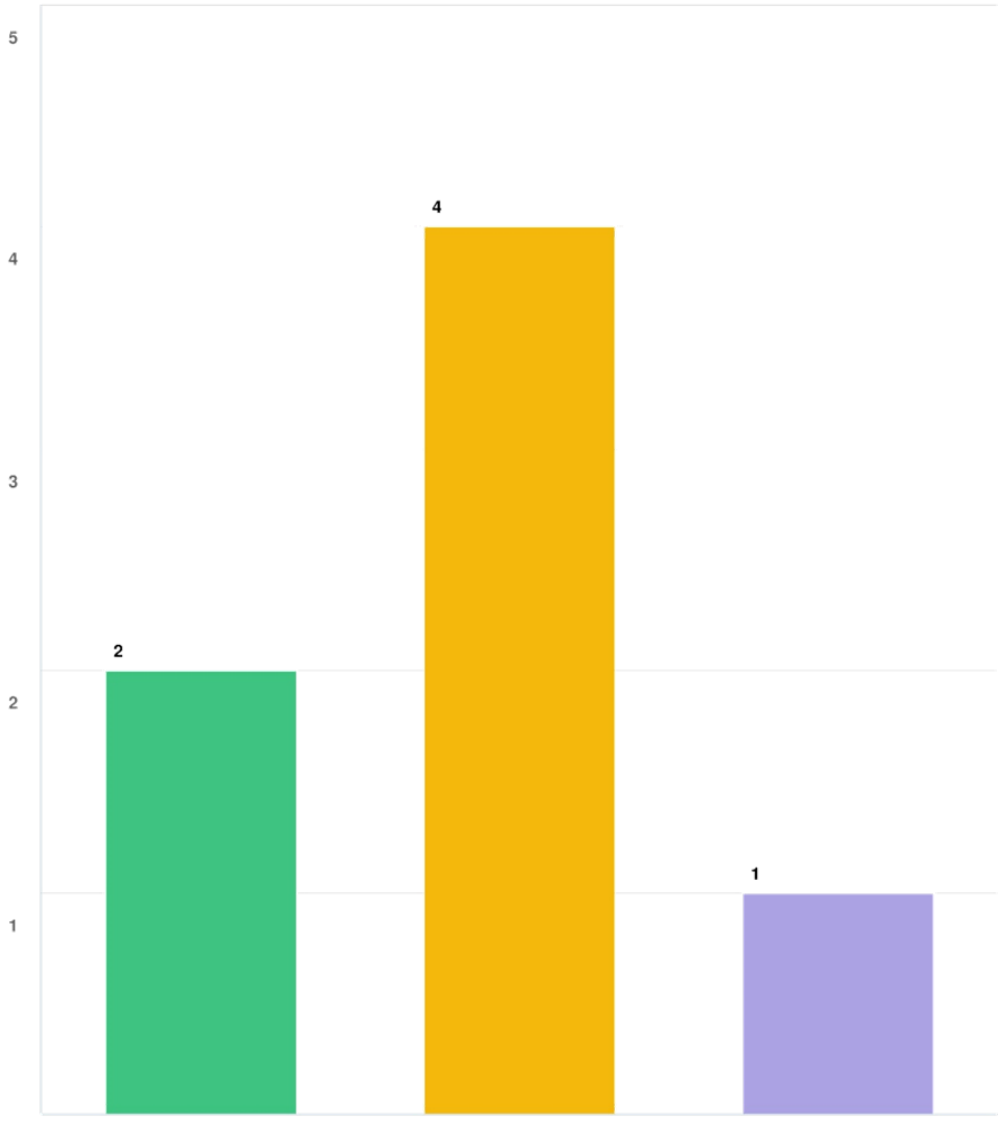
Optional question (7 responses, 4 skipped)

Q13 **Riparian vegetation management - Do you think the recommended actions will contribute to the vision and management objectives?**



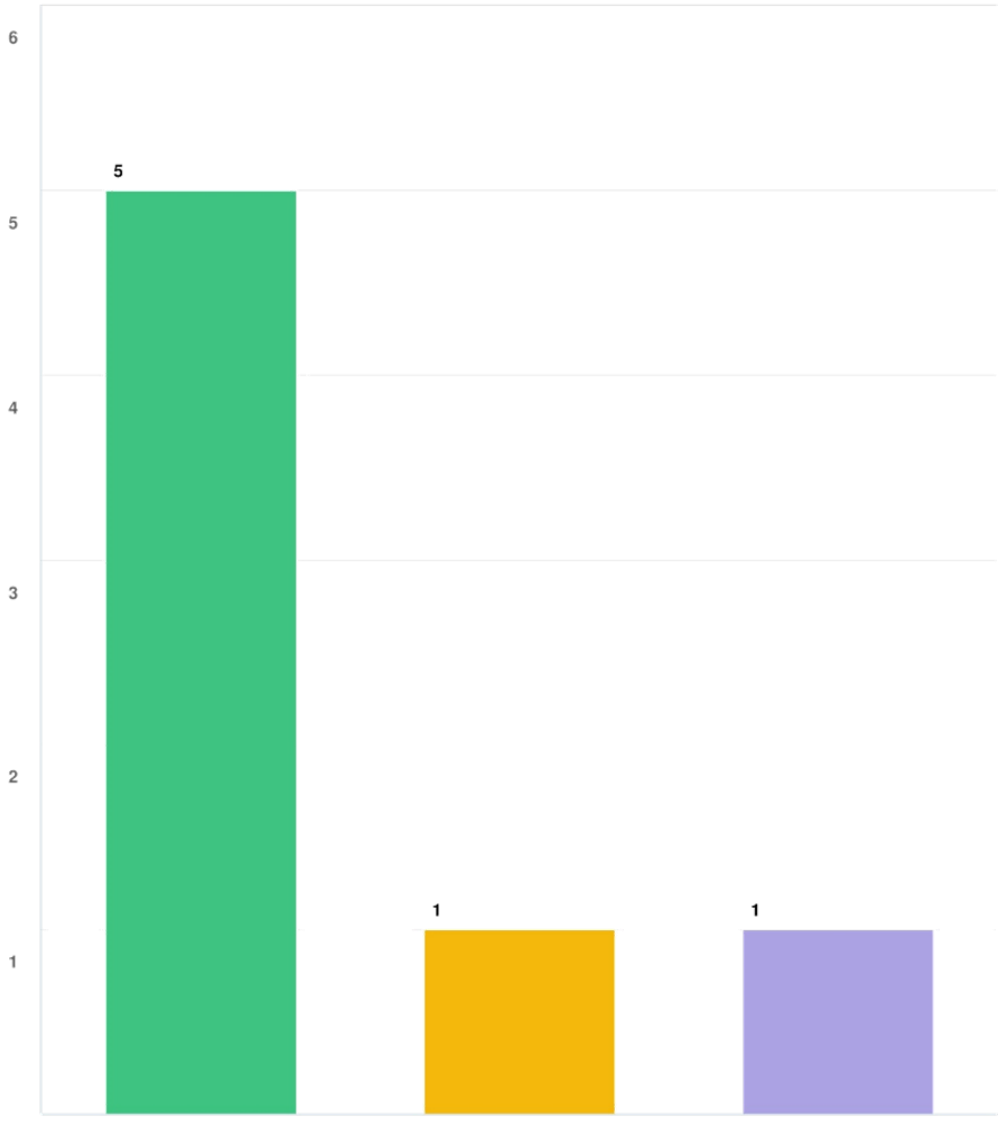
Optional question (7 responses, 4 skipped)

Q14 Understanding and protecting waterbirds - Do you think the recommended actions will contribute to the vision and management objectives?



Optional question (7 responses, 4 skipped)

Q15 **Controlling invasive species - Do you think the recommended actions will contribute to the vision and management objectives?**

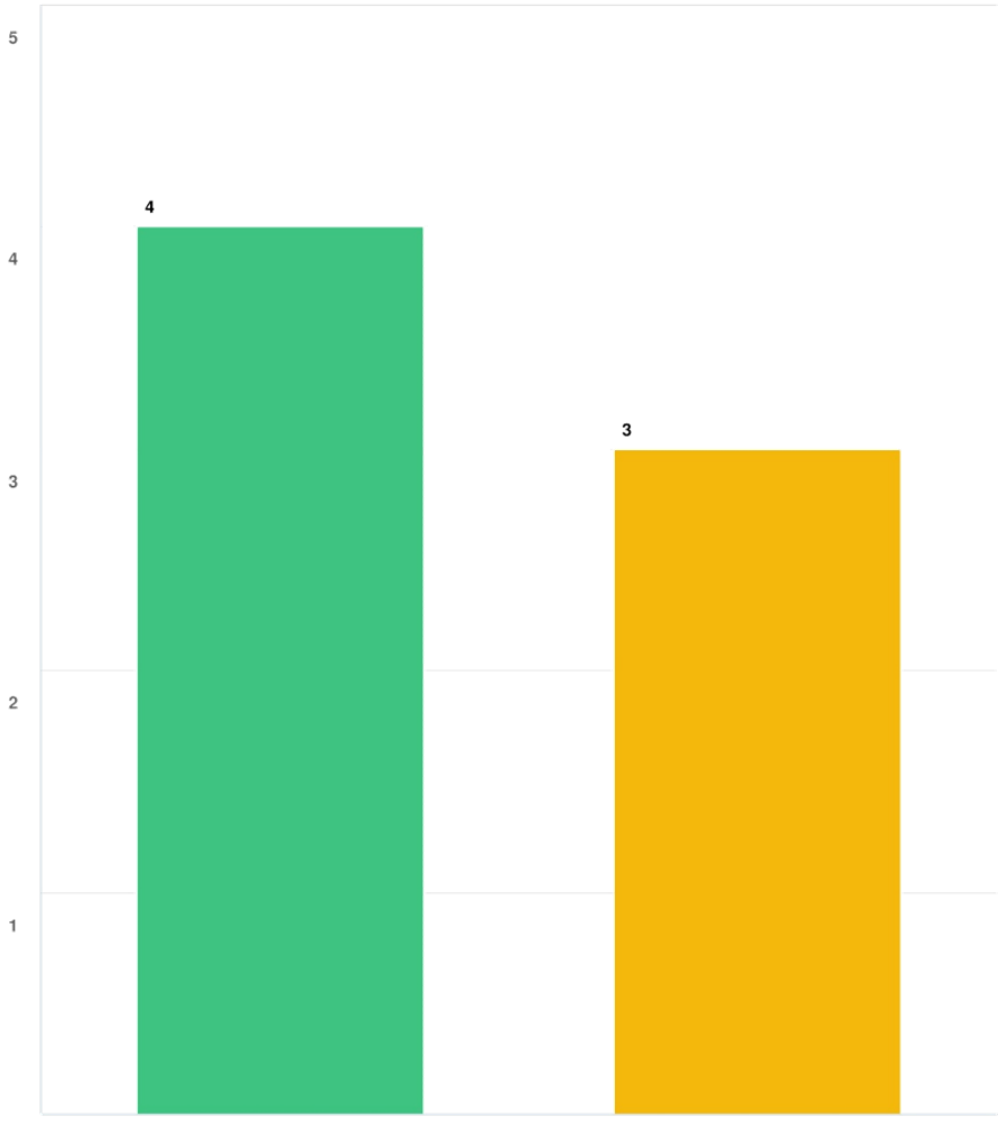


Question options

Significantly Somewhat Not at all

Optional question (7 responses, 4 skipped)

Q16 **Optimising flows - Do you think the recommended actions will contribute to the vision and management objectives?**

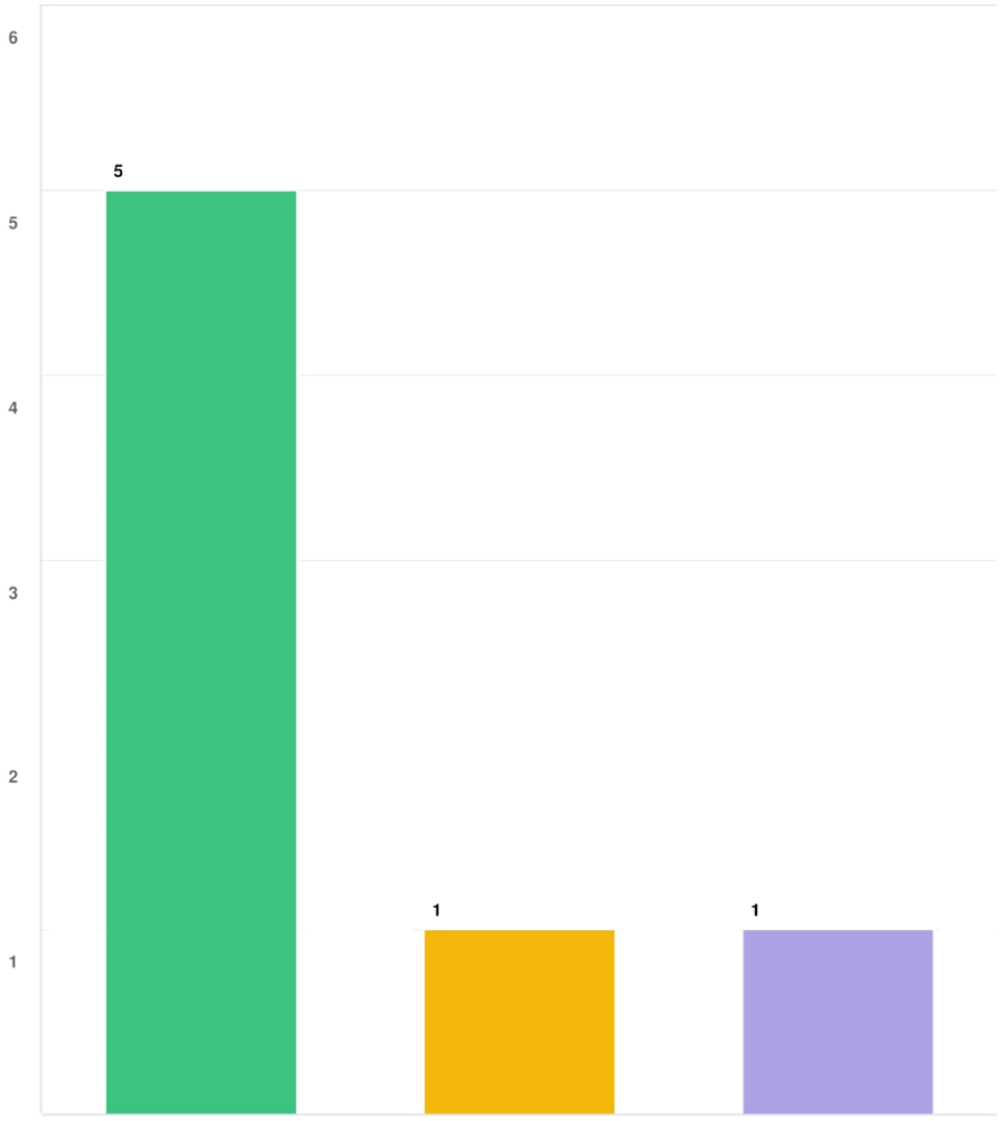


Question options

Significantly Somewhat

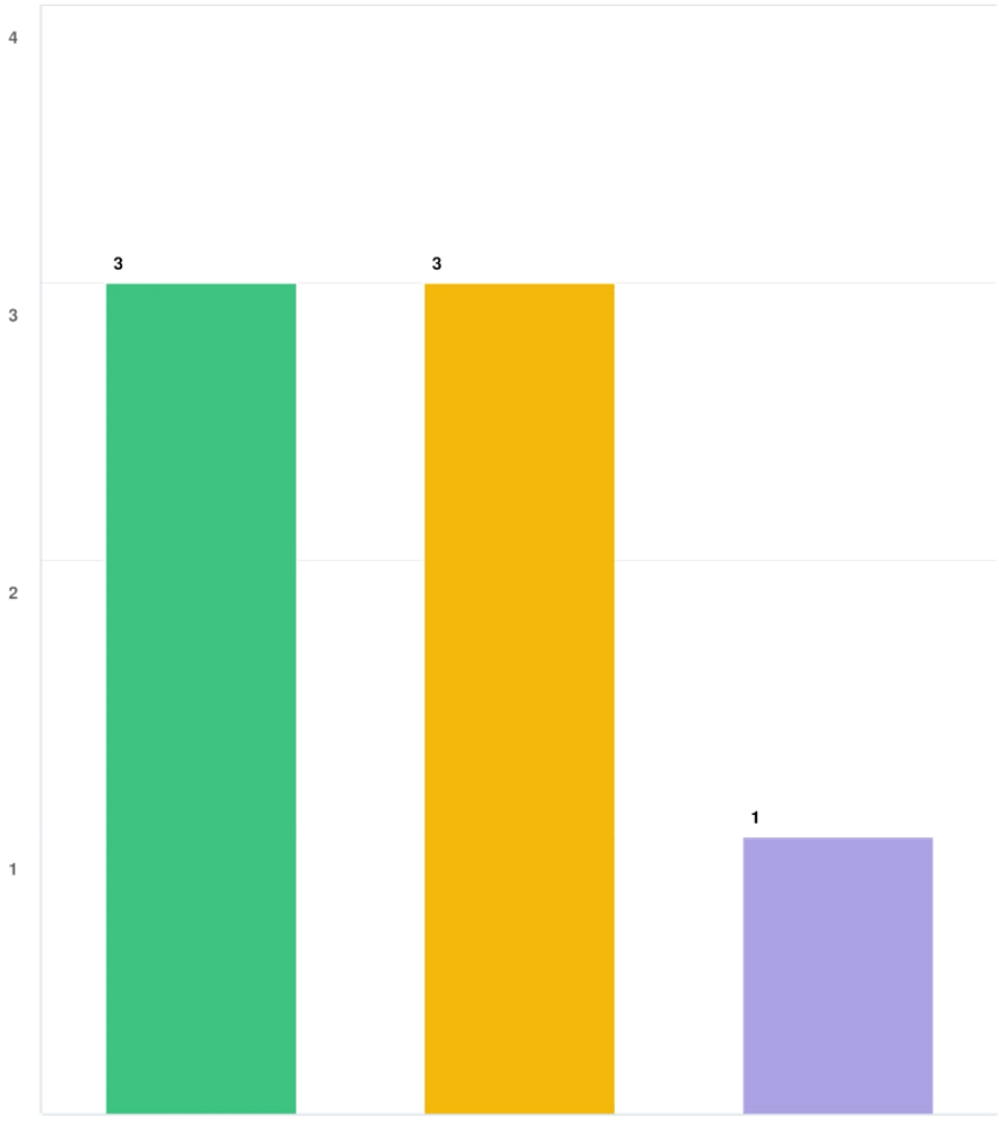
Optional question (7 responses, 4 skipped)

Q17 Sediment removal - Do you think the recommended actions will contribute to the vision and management objectives?



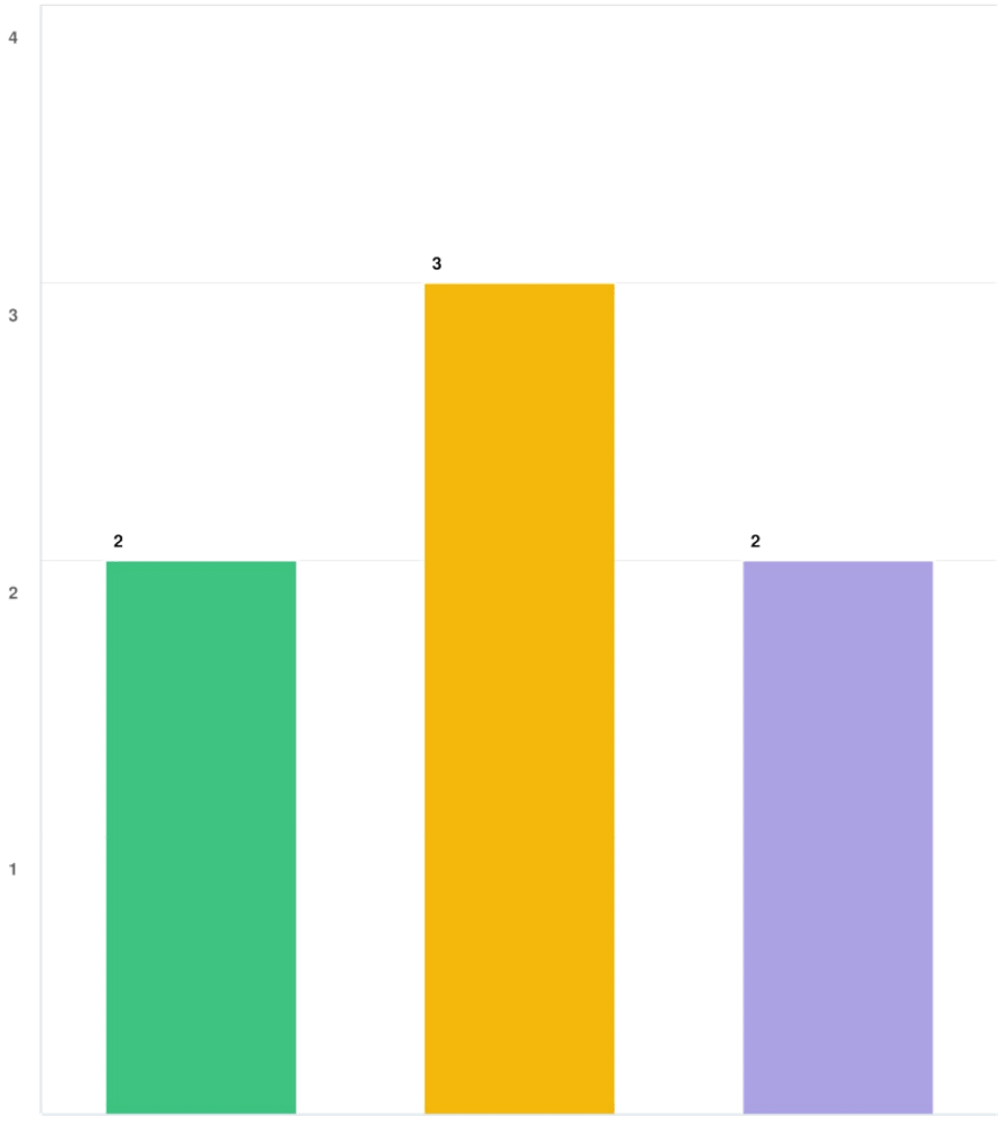
Optional question (7 responses, 4 skipped)

Q18 **Improving information and facilities - Do you think the recommended actions will contribute to the vision and management objectives?**



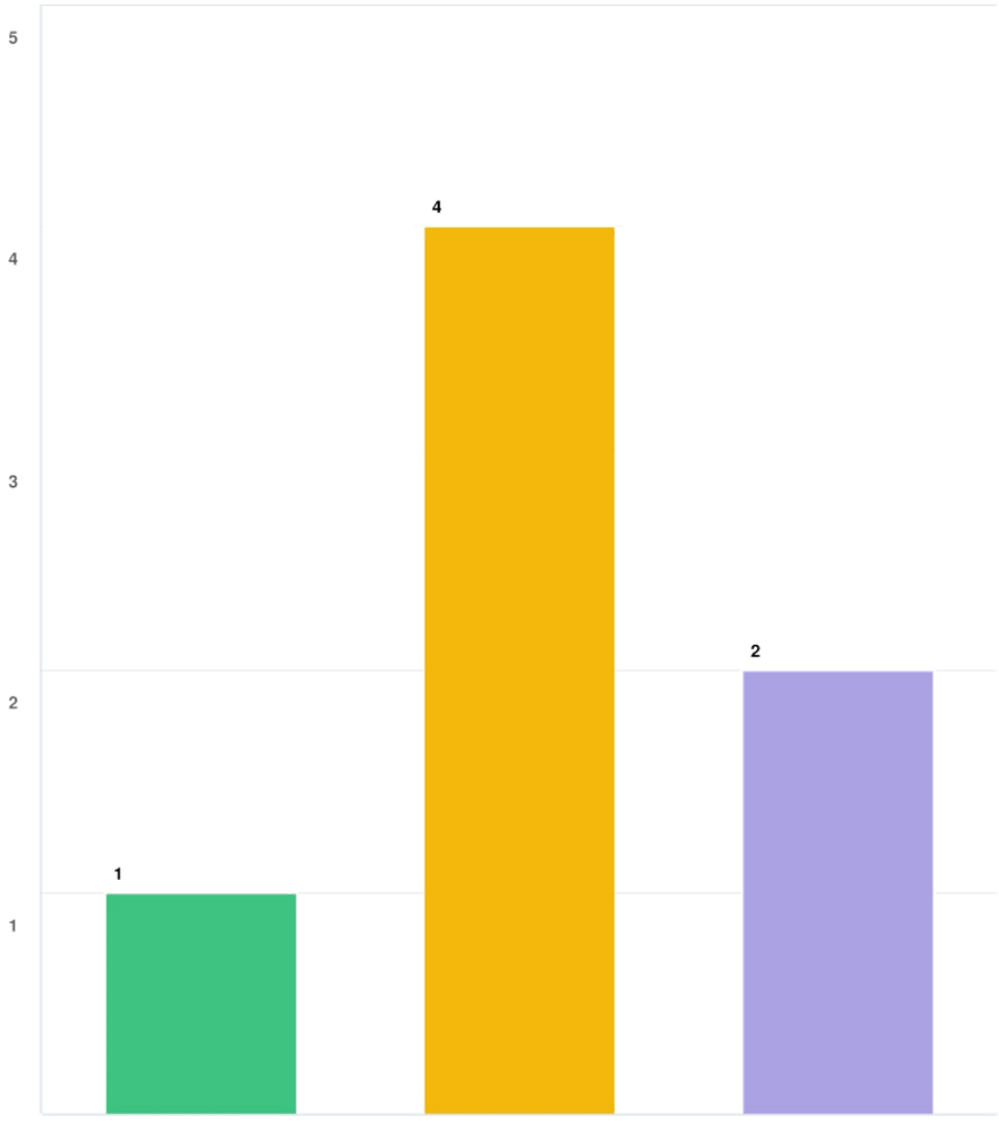
Optional question (7 responses, 4 skipped)

Q19 **Public health management - Do you think the recommended actions will contribute to the vision and management objectives?**



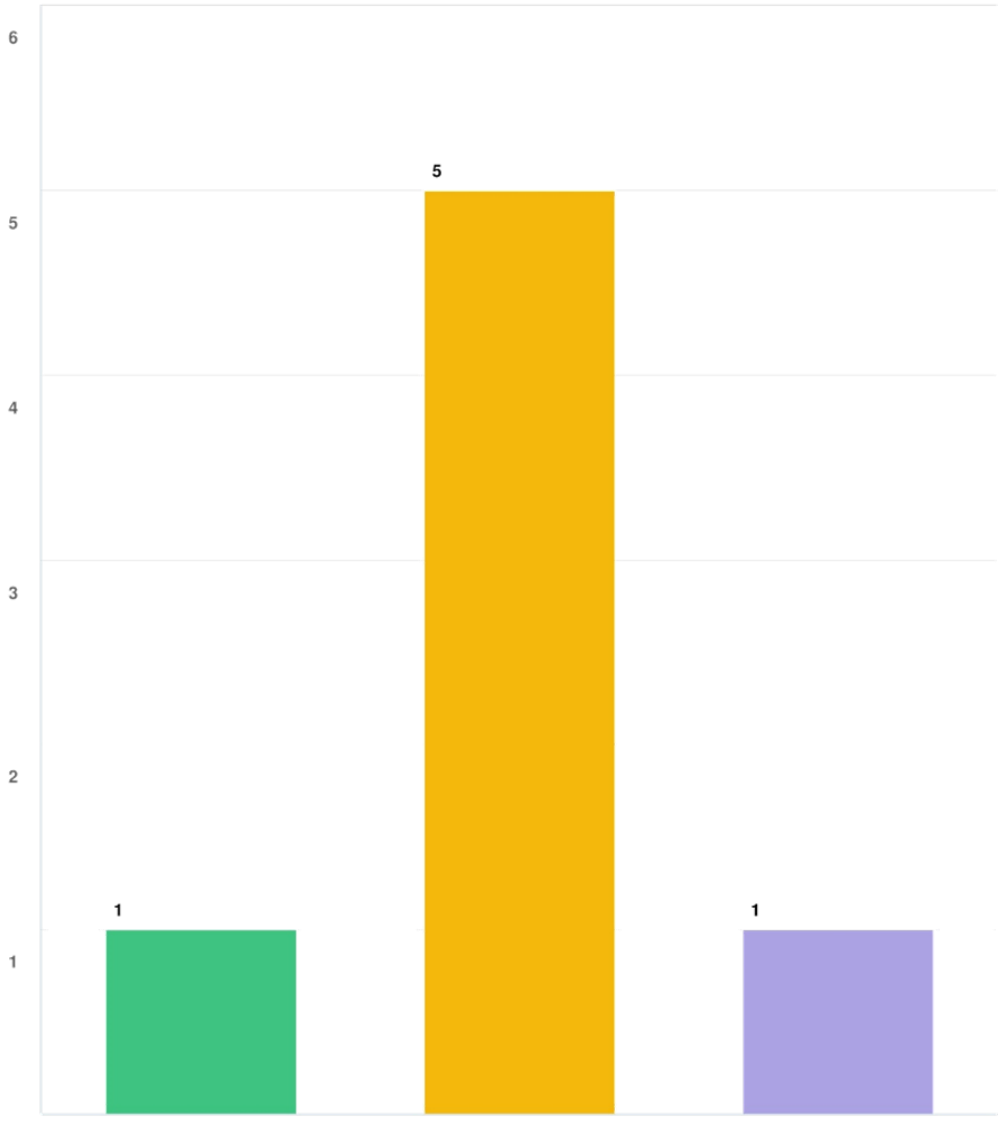
Optional question (7 responses, 4 skipped)

Q20 **Recognising Wadandi custodianship - Do you think the recommended actions will contribute to the vision and management objectives?**



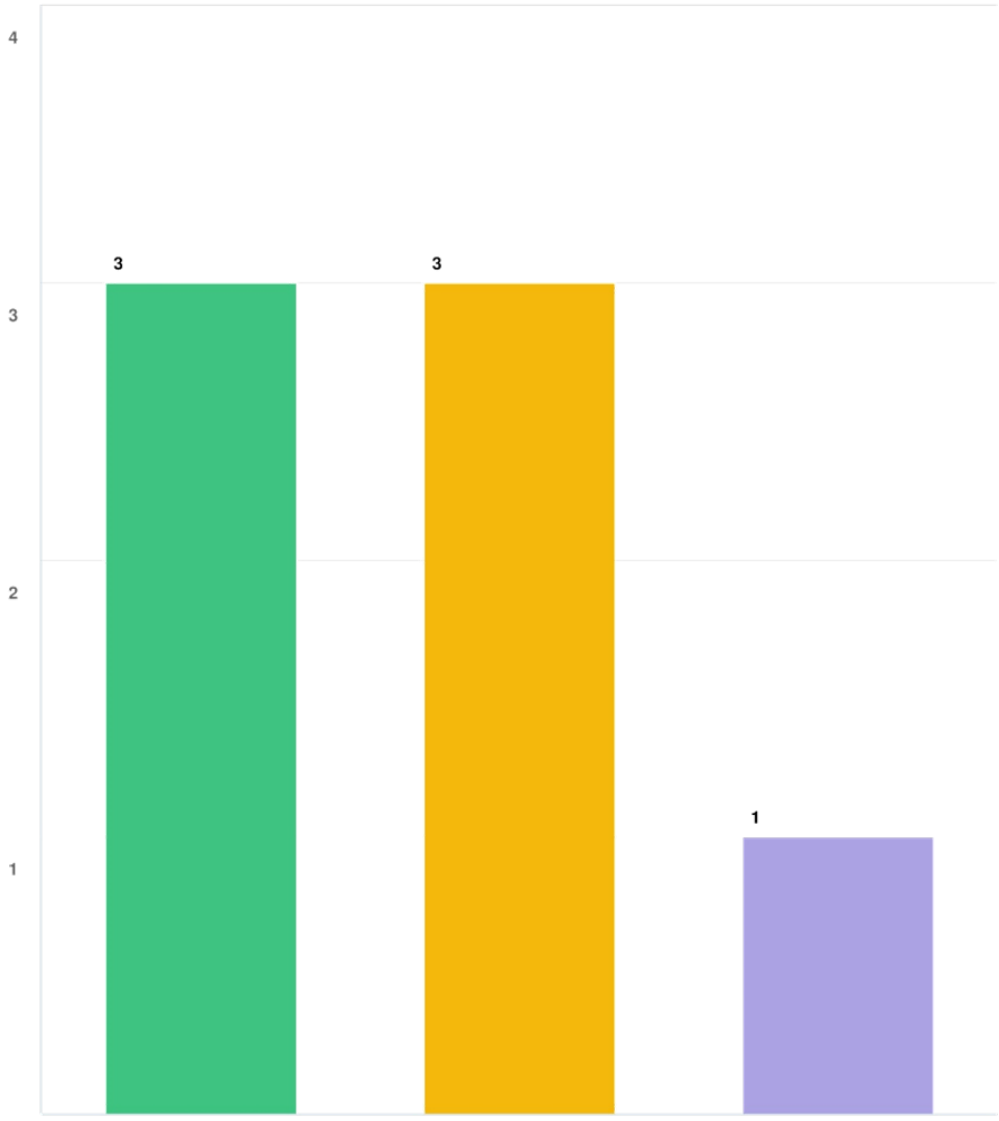
Optional question (7 responses, 4 skipped)

Q21 **Preserving historical values - Do you think the recommended actions will contribute to the vision and management objectives?**



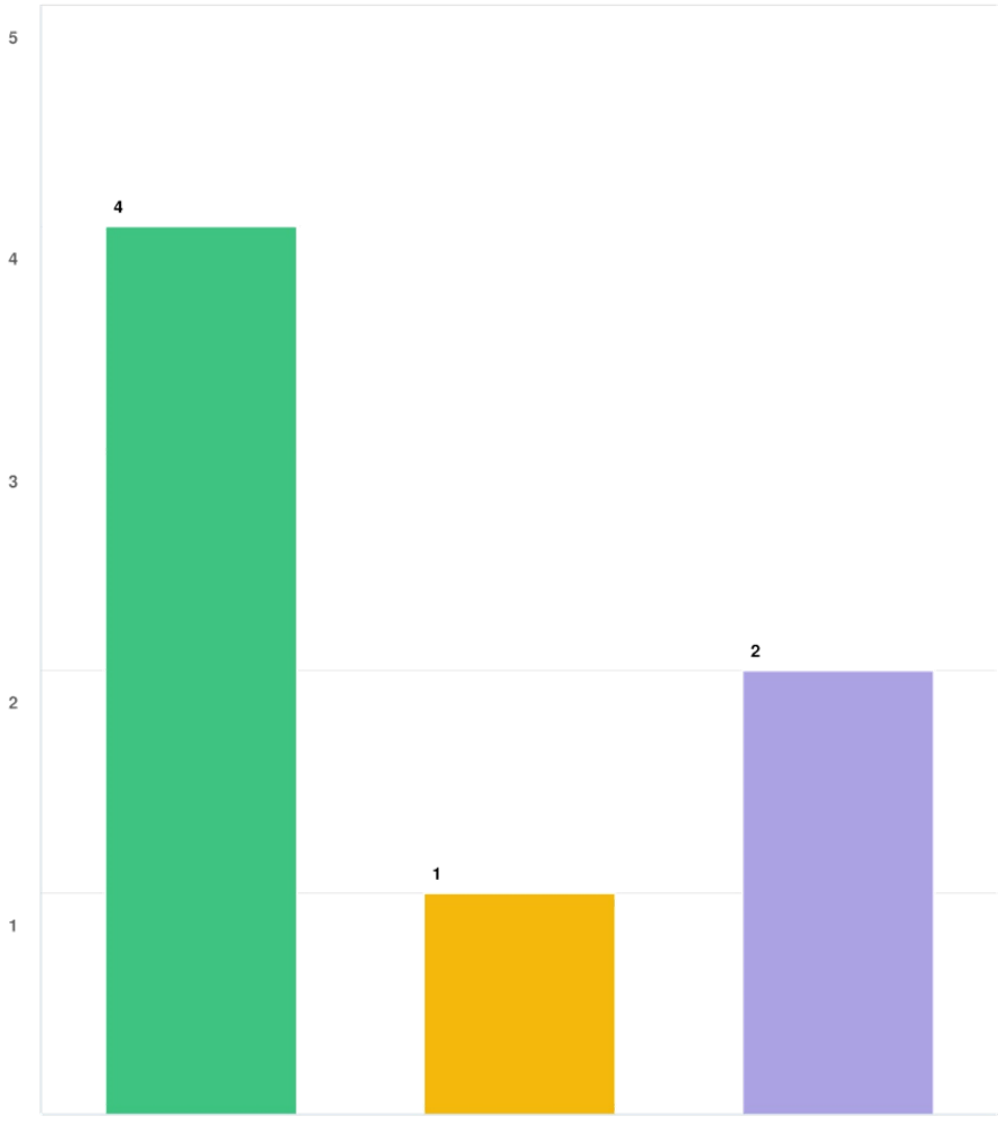
Optional question (7 responses, 4 skipped)

Q22 **Collaborative and adaptive management - Do you think the recommended actions will contribute to the vision and management objectives?**



Optional question (7 responses, 4 skipped)

Q23 Optimising planning tools - Do you think the recommended actions will contribute to the vision and management objectives?



Optional question (7 responses, 4 skipped)

Q24 **Do you have any further comments relating to any of these management strategies?**

stuart anderson 1/21/2019 04:08 PM	The management strategies do not fix the problem in the short term. There are a lot of proven strategies to remove algae bloom which haven't even been considered or looked at. Further the phosphorous issue is only part of the picture and there are aspects that haven't been considered. The barriers put in place where a waste of time and money. There is a direct evident source that hasn't been considered. It this was looked at it would solve the algae bloom instantly.
Jillee 1/29/2019 12:59 PM	Unless significant action is taken to control the invasive Mexican water lilies upstream from the Strelly Street bridge, all native birds will need to find another habitat. The lilies may contribute to improved water quality however, allowing them to completely choke the river is highly irresponsible. The council needs to lobby State and Federal governments for funds to deal with this problem and they need to do it now. Our wildlife is too precious to be squeezed out by introduced weeds.
John 2/02/2019 11:33 AM	Stop commercial fish netting in the Lower Vasse River. Reasons: The damage to banks from commercial fish boat launching. The use of a powerboat to lay the nets damages the river banks. The extraction of many native fish in a sensitive ecological area. The disruption and noise to households in close proximity to the commercial fishing given this happens at night. Finally fish netting in the Vasse is a historic occupation with minimal commercial gain, maximum ecological damage and has no place in this environment in current time.
JGBUSSELL 2/05/2019 11:16 PM	Regarding the plan for water movement, there is no mention of using a large water fountain to oxygenate the river. Please add this to the plan. Lastly I fully agree the check boards should be totally removed and thrown on the nearest bonfire. If you can't see what 100 years of sediment build up does to the river, then we aren't gonna get far. The living streams idea is mostly a waist of money that you don't even have and building man made ponds is pretty ridiculous. Remove the boards and dredge the silt please!
KLiversidge 2/26/2019 09:42 PM	We would like to see more seasonal water flowing into the Lower Vasse as per the recommended action. Given the issues with the risk of increased nutrient levels has consideration been given to some form of filtration/water treatment just below the valve(s). For example, create an artificial wetland which then drains into the Lower Vasse or removing just the phosphates either mechanically or chemically as the water passes through the valve(s), are there any mining solutions? Contaminated water could then be redirected back into the diversion drain allowing 'cleaner' water to flow into the Lower Vasse. Is there potential for controlled flow of additional clean ground water to be utilized to further dilute nutrients? Given that a lot more research needs to be undertaken, the Living Streams approach and dramatic changes to the Lower Vasse as described in the draft WMP will most likely take too long to implement and be too expensive. Although it would be nice, I don't believe that the Lower Vasse can be returned to as it was 100+ years ago without

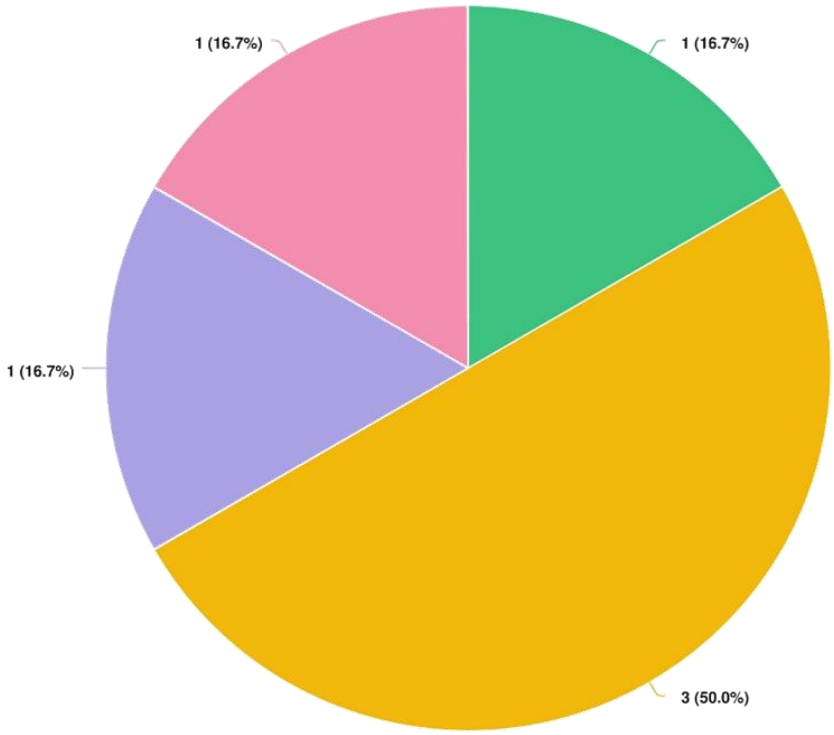
	significant ongoing cost to the community which will not always be guaranteed as governments and public perceptions and priorities change. There are many aspects of the draft WMP that can be implemented in the short/medium term that will create a healthier river and more attractive waterway without major earthworks. We wonder about the City of Busselton's commitment to the amenity of the river especially along Peel Tce and Rotary Park given the Eastern Link road system will impact the visual appeal of this part of the river. Definitely no water craft on the river!!

Optional question (5 responses, 6 skipped)


Survey Report
01 December 2018 - 28 February 2019
Toby Inlet - Waterway Management Plan Survey
PROJECT: Waterway Management Plans
Your Say Busselton
engagement hq
by Bang the Table

Toby Inlet - Waterway Management Plan Survey : Survey Report for 01 December 2018 to 28 February 2019

Q1 Do you feel that the information about Toby Inlet and its management issues is sufficient and accurate?



Question options

Strongly Agree Agree Neutral Disagree

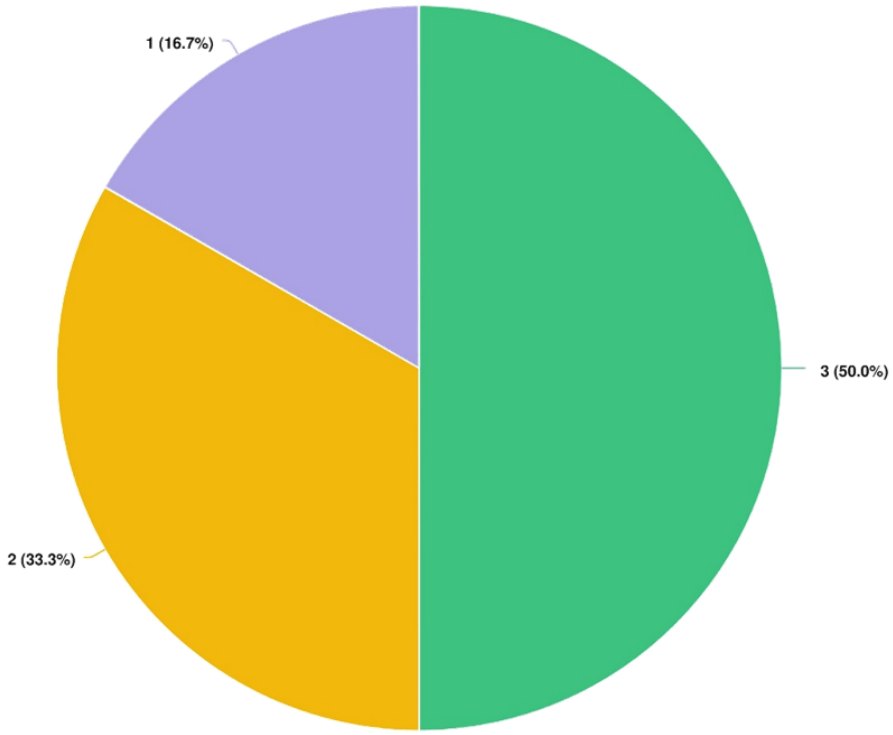
(6 responses, 0 skipped)

Q2 Do you have any further comments on the information available?

Anna marchesani 1/28/2019 12:12 PM	The inlet has been dry smelly and is toxic we don't even have a mosquito problem I am concerned for the birds ducks and water life also concerning is the knee deep mud should a child or dog fall in there
John McCallum 2/01/2019 05:31 PM	Locals provided some fo the gaps in the nature and previous management of the waterway which was really helpful
rmc 2/07/2019 01:04 PM	The weed Hydrocotyle bonariensis is not listed in the species list. I discovered this species (2015 I think) on the bike path between the bike bridge and Station Gully some years ago and alerted the City.

Optional question (3 responses, 3 skipped)

Q3 Overall, do you believe the list of management strategies and actions are suitable to address management issues?

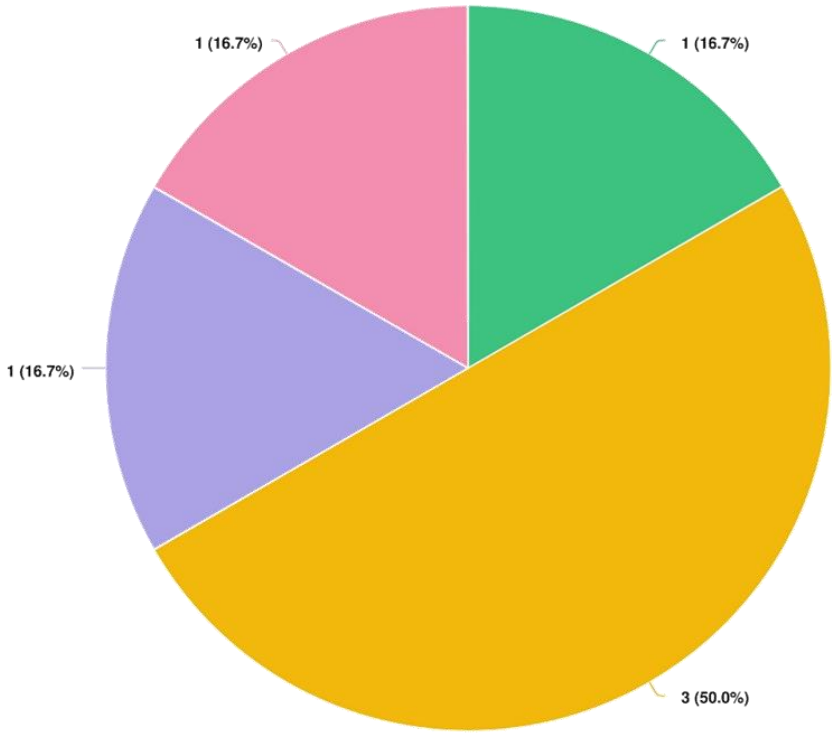


Question options

Strongly agree Agree Disagree

(6 responses, 0 skipped)

Q4 Do you feel that the plan provides clarity in how the waterway will be managed and who is responsible?

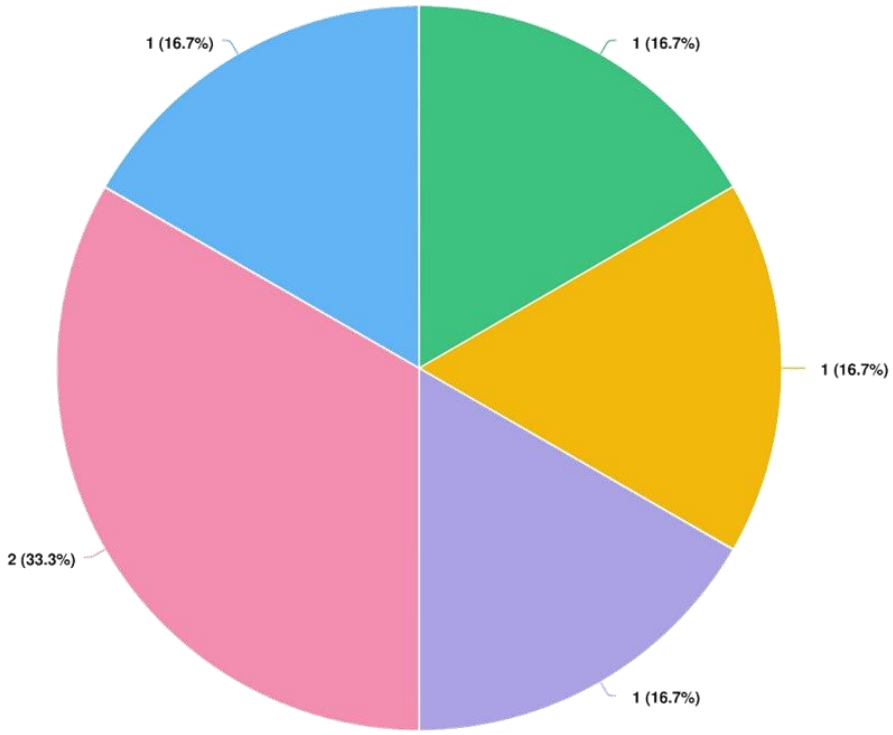


Question options

Strongly Agree Agree Neutral Disagree

(6 responses, 0 skipped)

Q5 Do you believe the City of Busselton should be the lead management agency for the waterway?

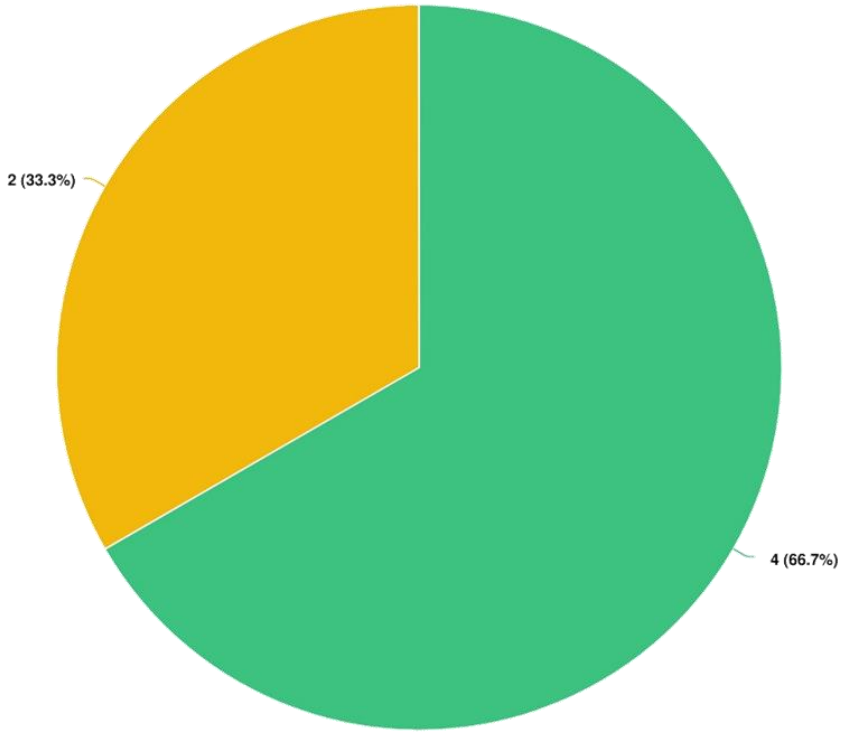


Question options

Strongly Agree Agree Neutral Disagree Strongly Disagree

(6 responses, 0 skipped)

Q6 What is your view on future funding for the management actions?

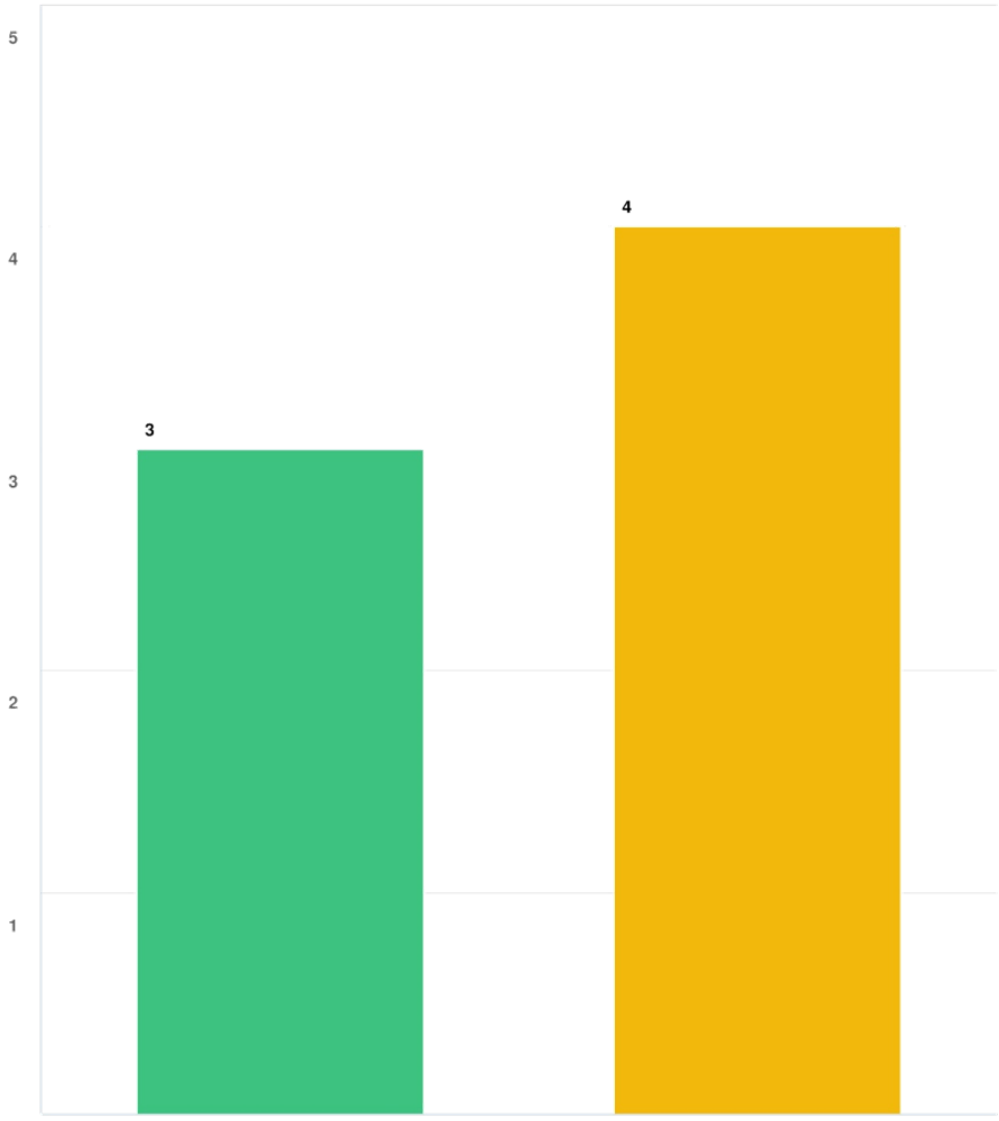


Question options

- Additional grant funding should be sought to implement priority actions
- The City should increase investment significantly and use this to seek more external funding

(6 responses, 0 skipped)

Q7 Would you like to provide further comment on each of the management strategies? (This question is OPTIONAL)

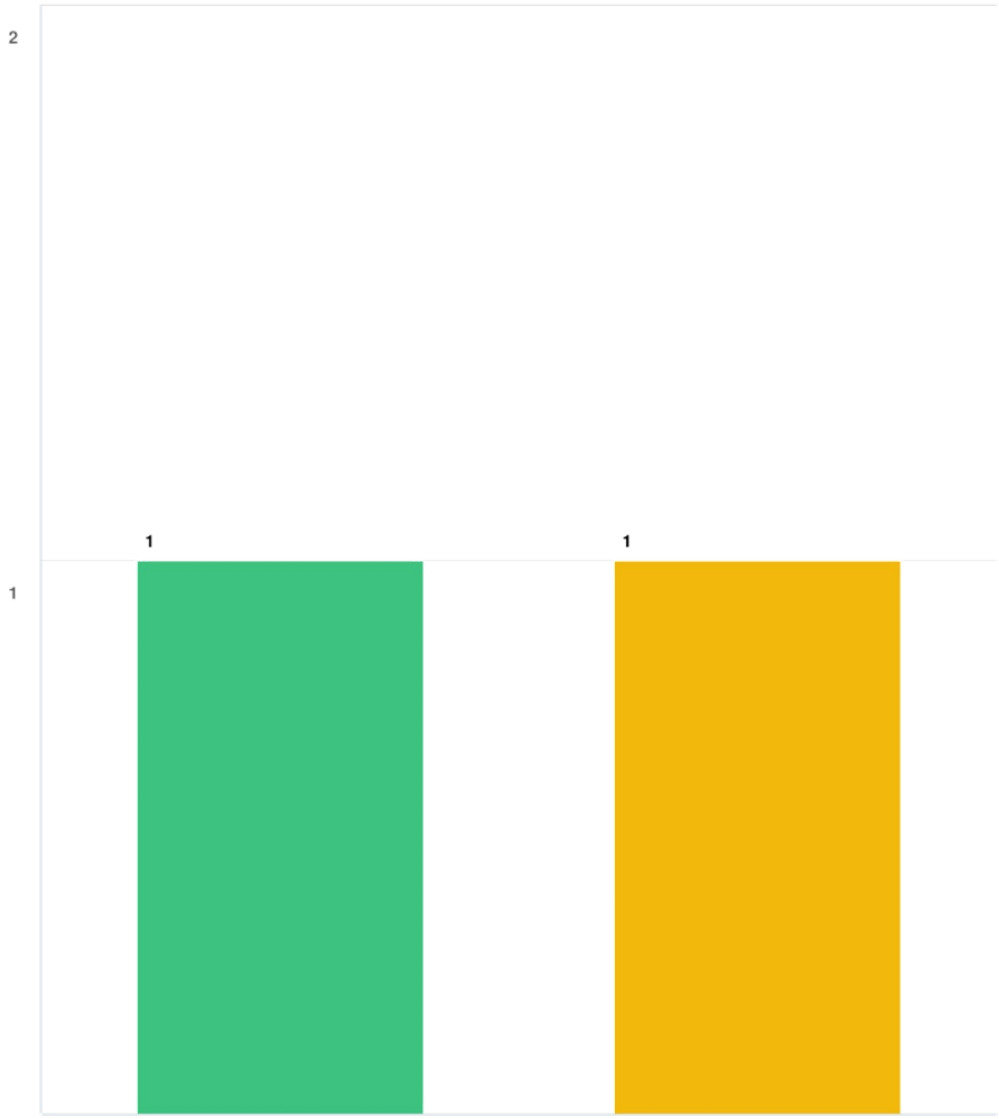


Question options

Yes No

(6 responses, 0 skipped)

Q8 Optimal management of Toby Inlet Ocean Exchange - Do you think the recommended actions will contribute to the vision and management objectives?

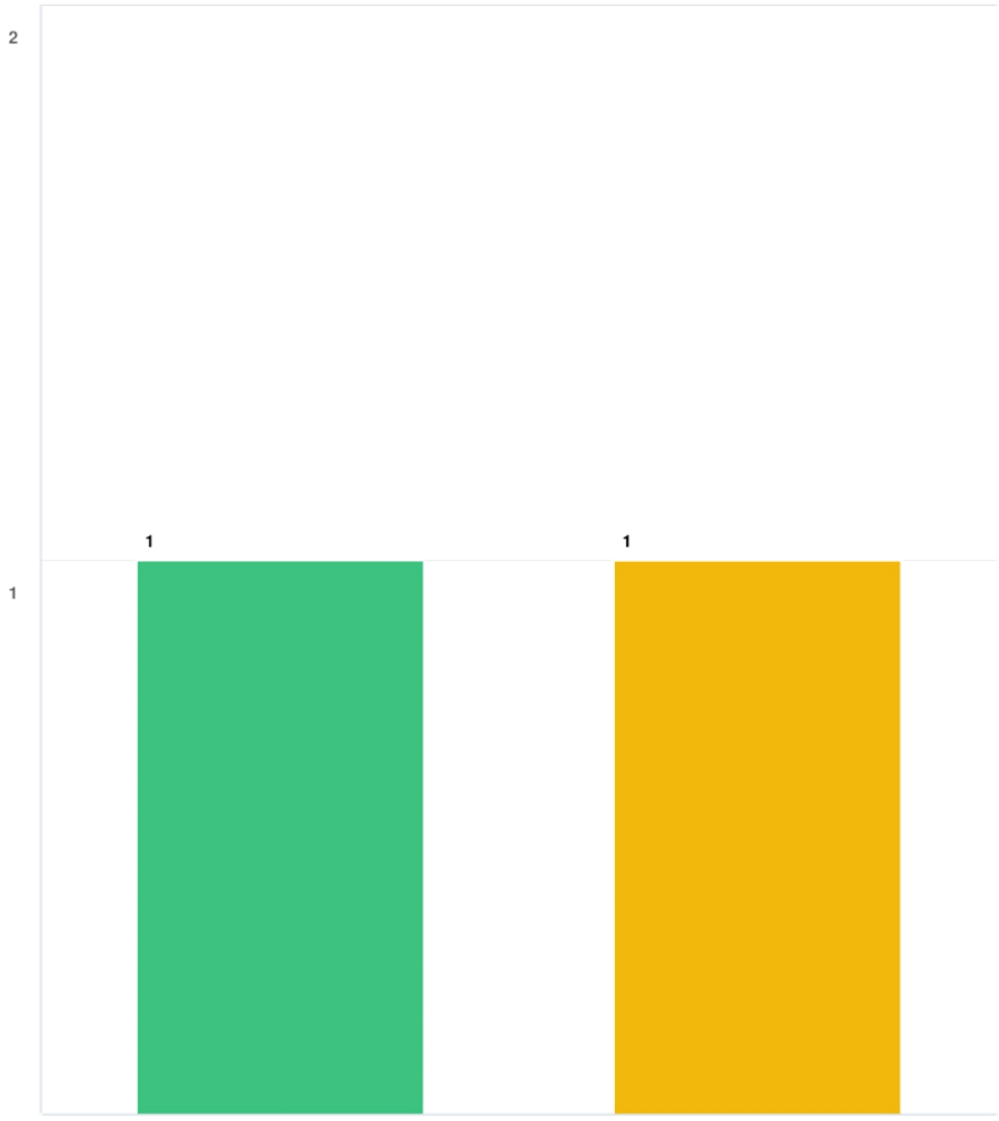


Question options

Significantly Not at all

Optional question (2 responses, 4 skipped)

Q9 Investigate sediment removal - Do you think the recommended actions will contribute to the vision and management objectives?

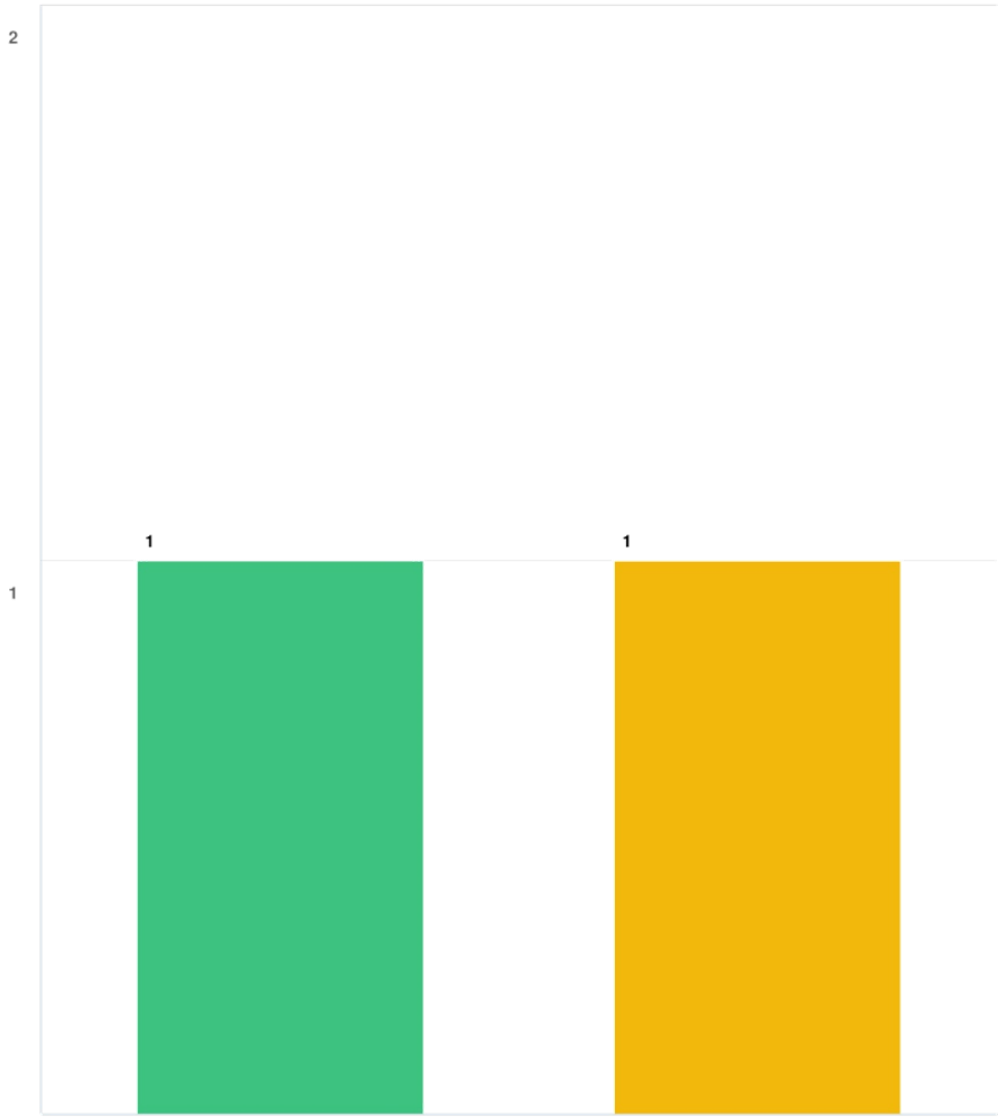


Question options

Significantly Somewhat

Optional question (2 responses, 4 skipped)

Q10 Enhance sediment movement through Toby Inlet - Do you think the recommended actions will contribute to the vision and management objectives?

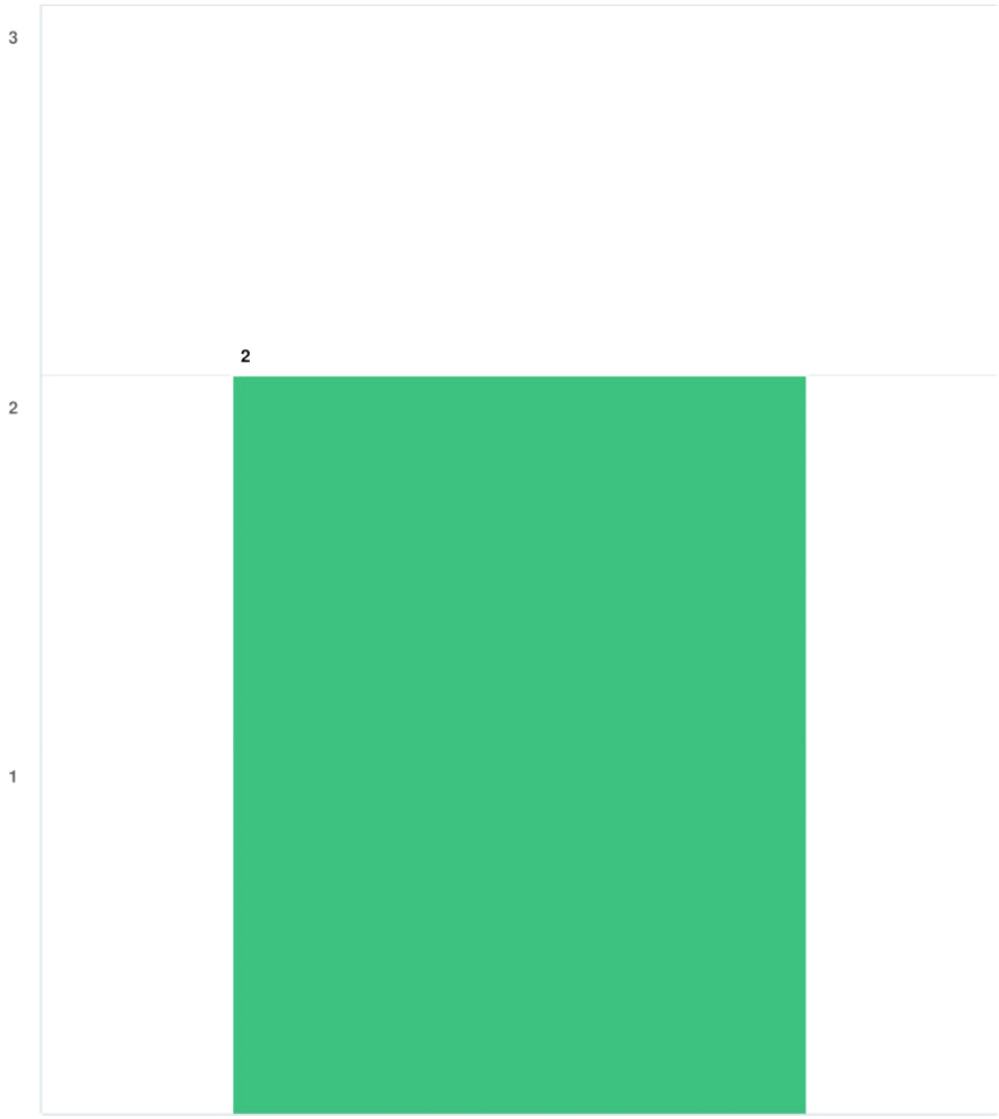


Question options

Somewhat Not at all

Optional question (2 responses, 4 skipped)

Q11 Prevent further sedimentation - Do you think the recommended actions will contribute to the vision and management objectives?

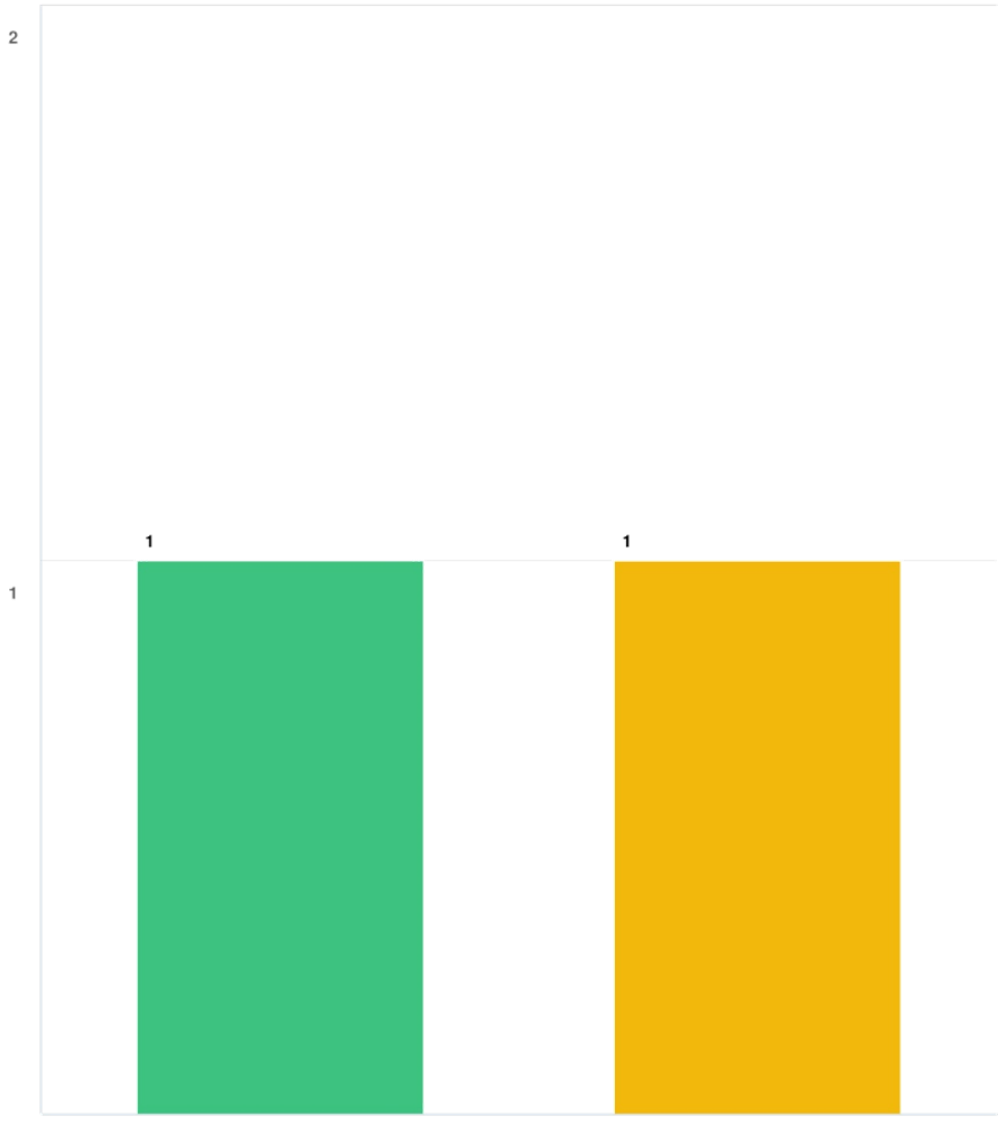


Question options

Significantly

Optional question (2 responses, 4 skipped)

Q12 Rehabilitate exposed sediment deposits - Do you think the recommended actions will contribute to the vision and management objectives?

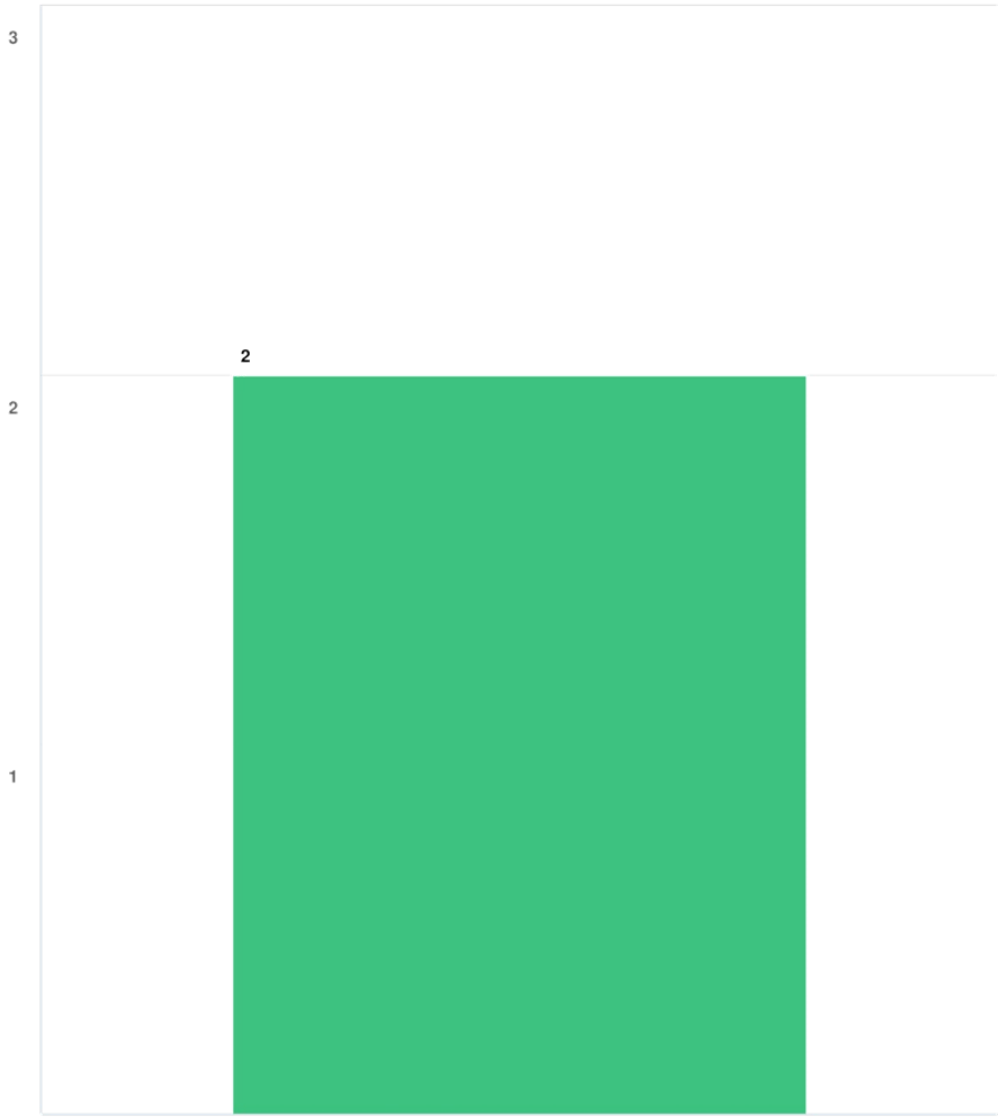


Question options

Significantly Somewhat

Optional question (2 responses, 4 skipped)

Q13 Reducing nutrient sources from the catchment - Do you think the recommended actions will contribute to the vision and management objectives?

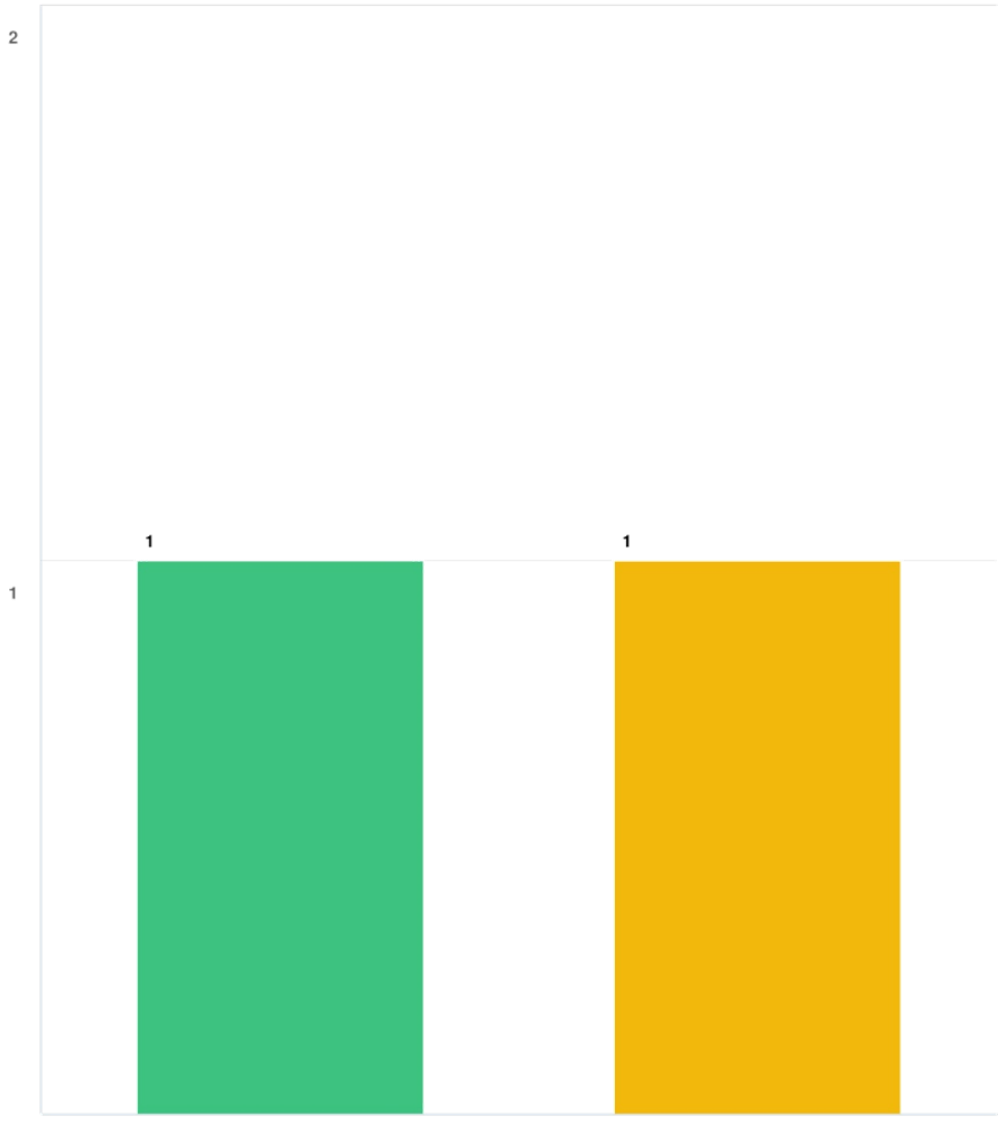


Question options

Significantly

Optional question (2 responses, 4 skipped)

Q14 Effectively manage foreshore reserves - Do you recommend actions will contribute to the vision and management objectives?

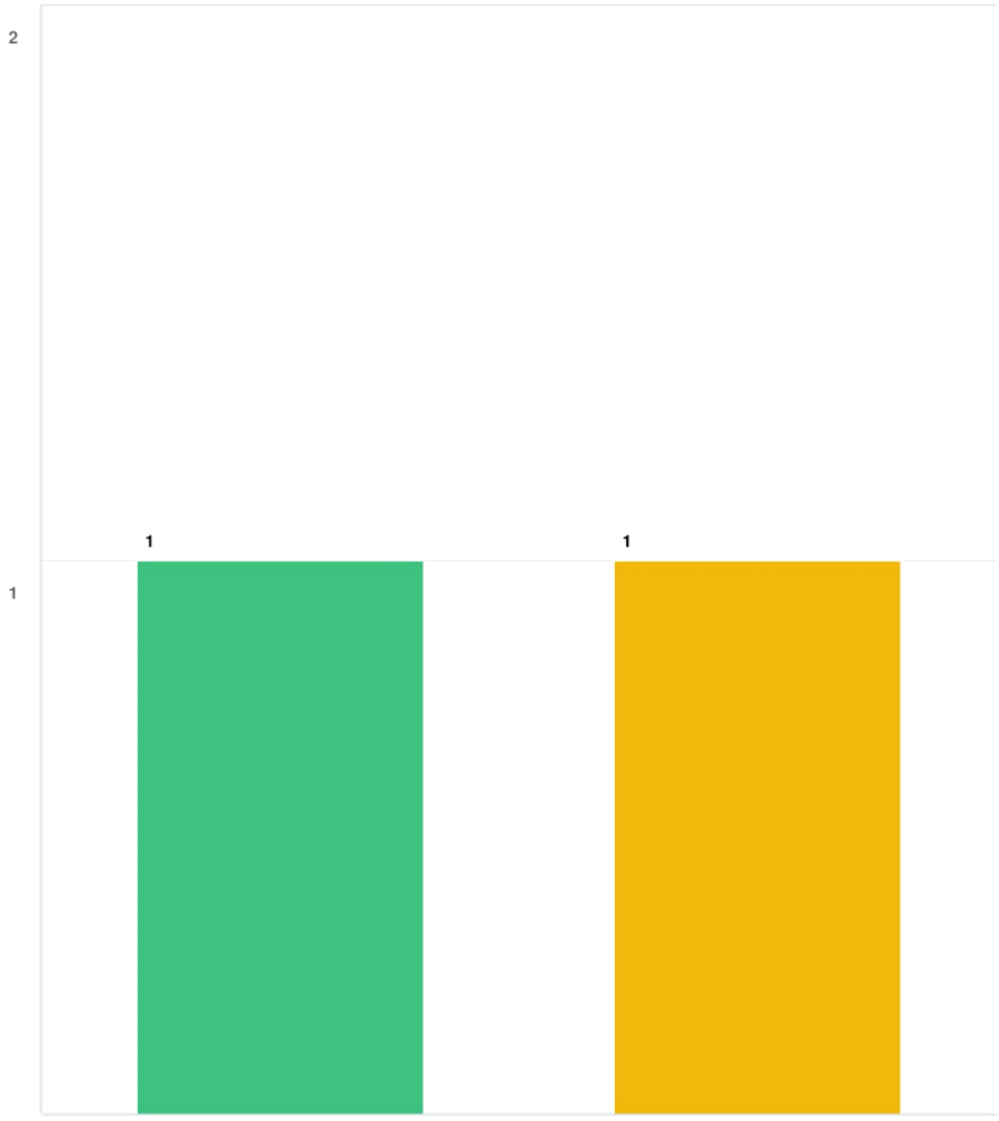


Question options

Significantly Somewhat

Optional question (2 responses, 4 skipped)

Q15 Understanding fauna - Do you think the recommended actions will contribute to the vision and management objectives?

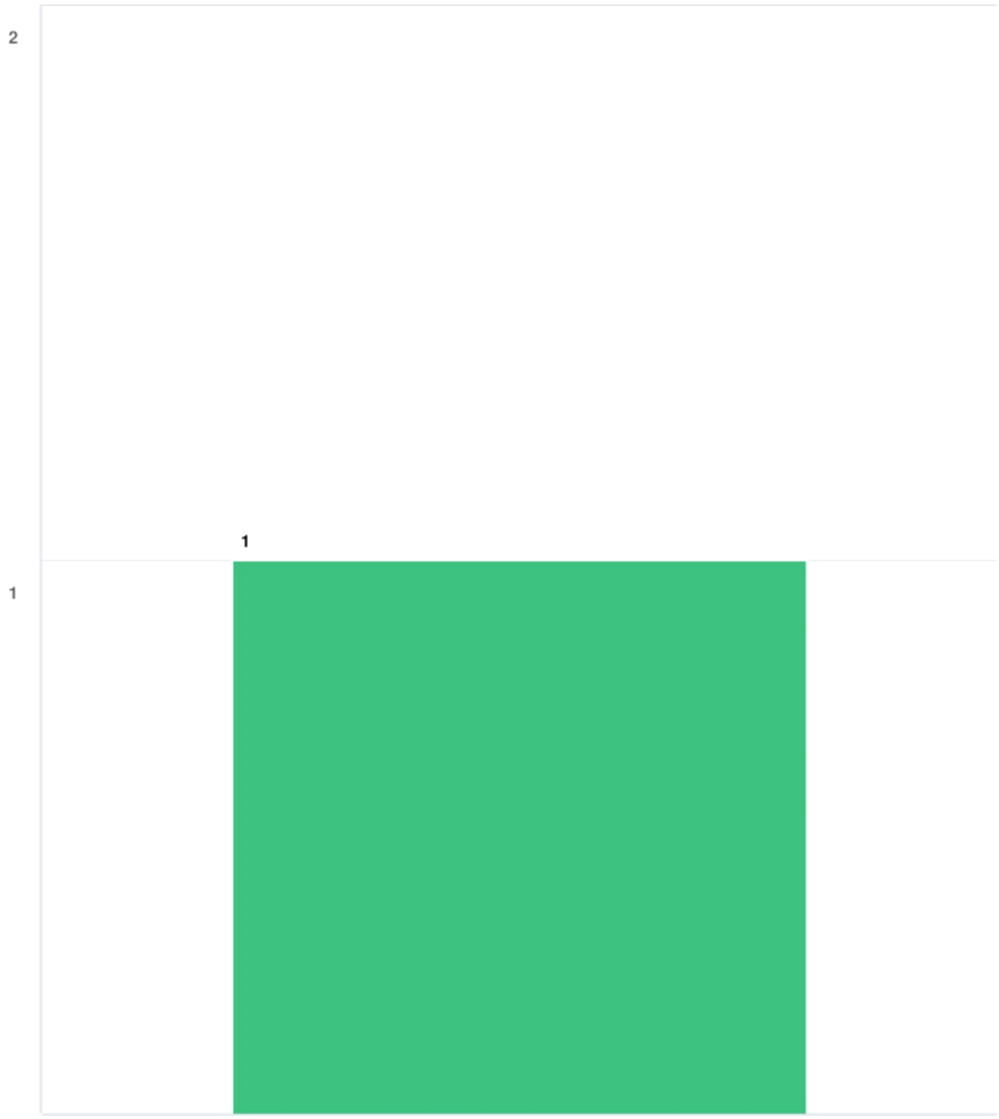


Question options

Significantly Somewhat

Optional question (2 responses, 4 skipped)

Q16 Improving facilities for community appreciation - Do you think the recommended actions will contribute to the vision and management objectives?

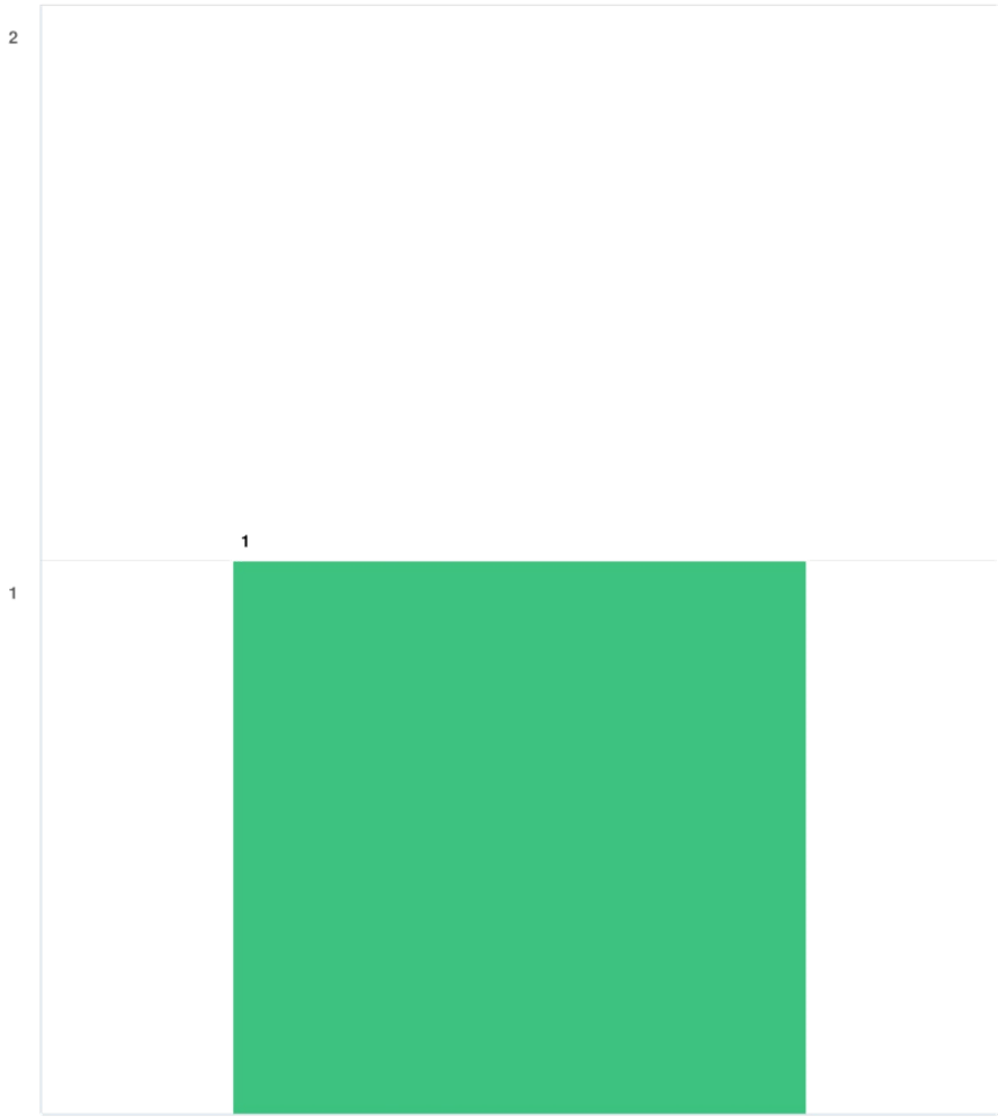


Question options

Significantly

Optional question (1 responses, 5 skipped)

Q17 Providing informative resources - Do you think the recommended actions will contribute to the vision and management objectives?

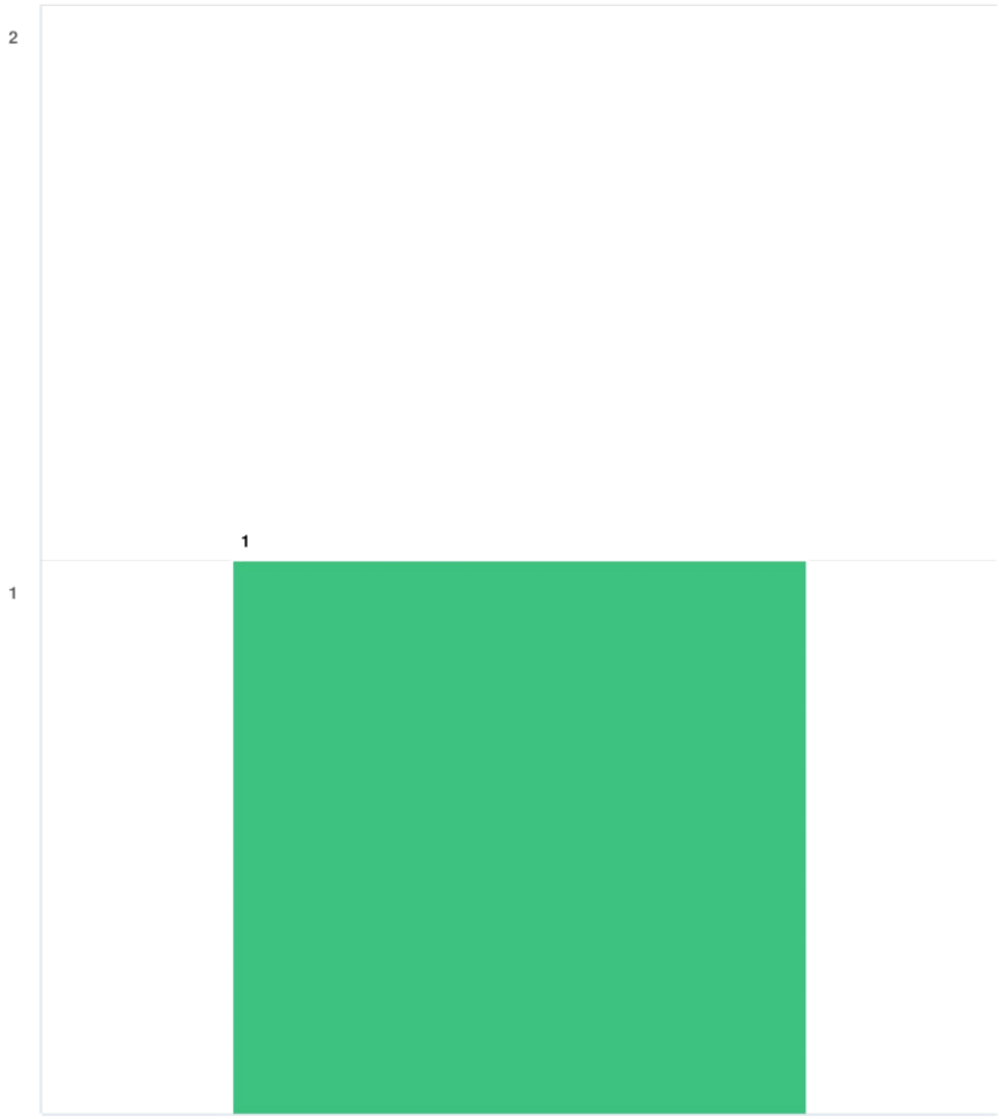


Question options

Significantly

Optional question (1 responses, 5 skipped)

Q18 Recognising Wadandi custodianship - Do you think the recommended actions will contribute to the vision and management objectives?

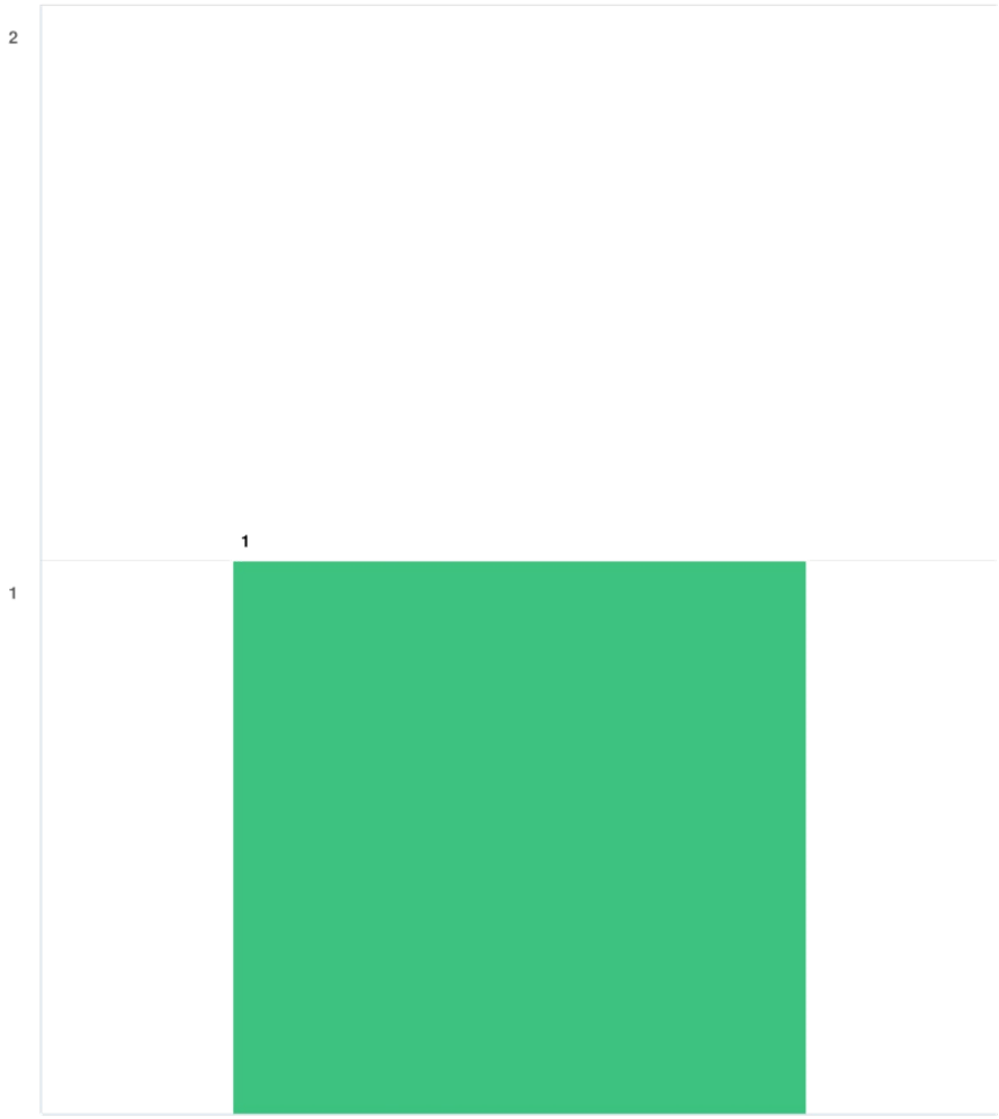


Question options

Significantly

Optional question (1 responses, 5 skipped)

Q19 Conserve historical values - Do you think the recommended actions will contribute to the vision and management objectives?

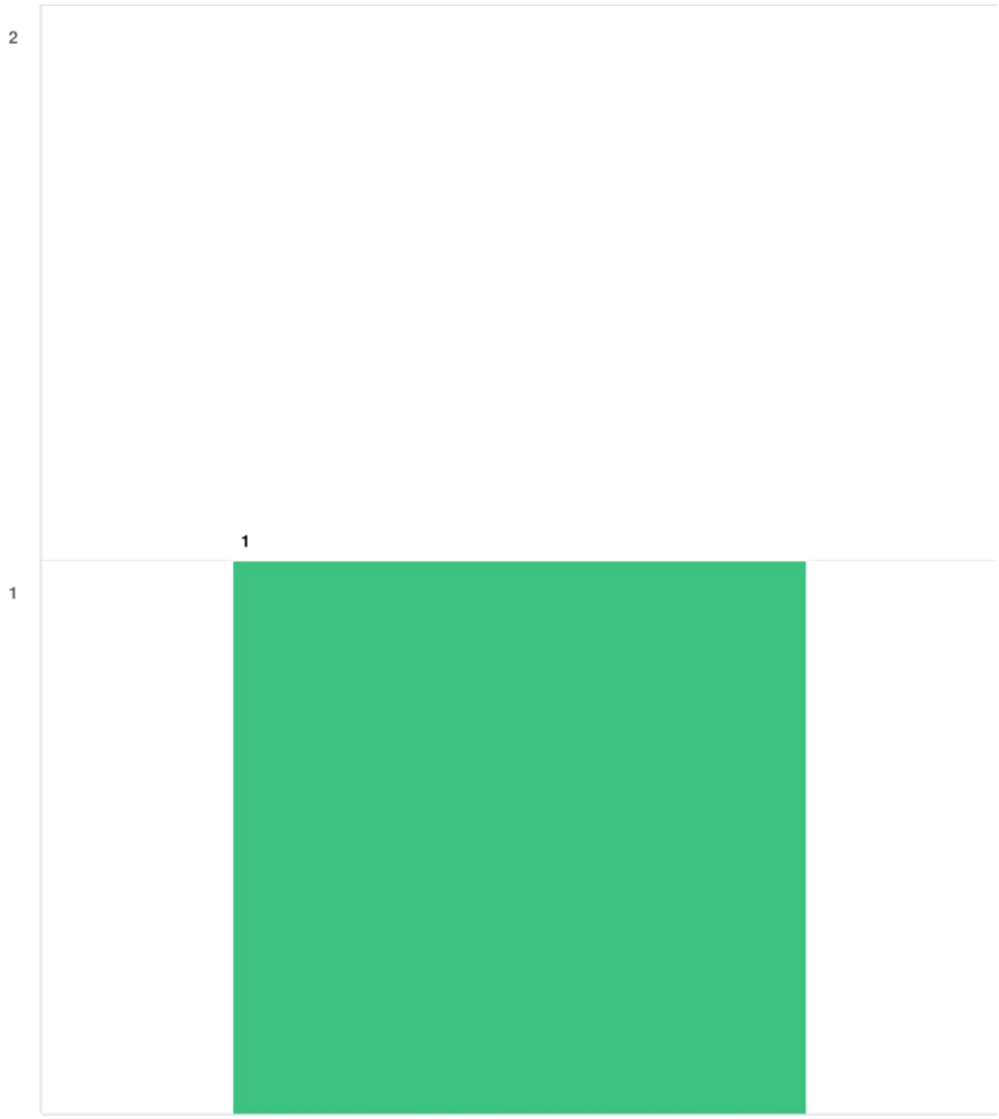


Question options

Somewhat

Optional question (1 responses, 5 skipped)

Q20 Preserving historical values - Do you think the recommended actions will contribute to the vision and management objectives?

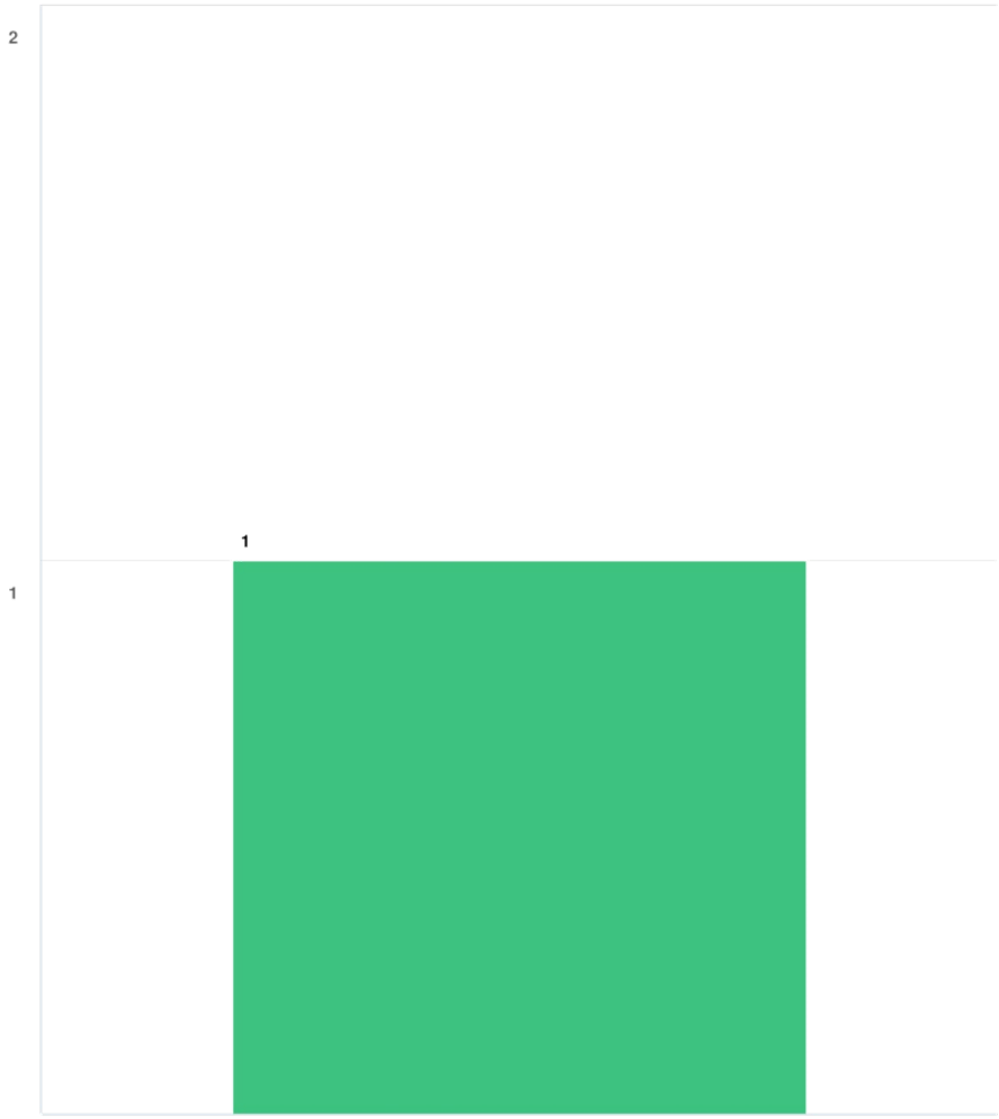


Question options

Somewhat

Optional question (1 responses, 5 skipped)

Q21 Defined and collaborative management - Do you think the recommended actions will contribute to the vision and management objectives?

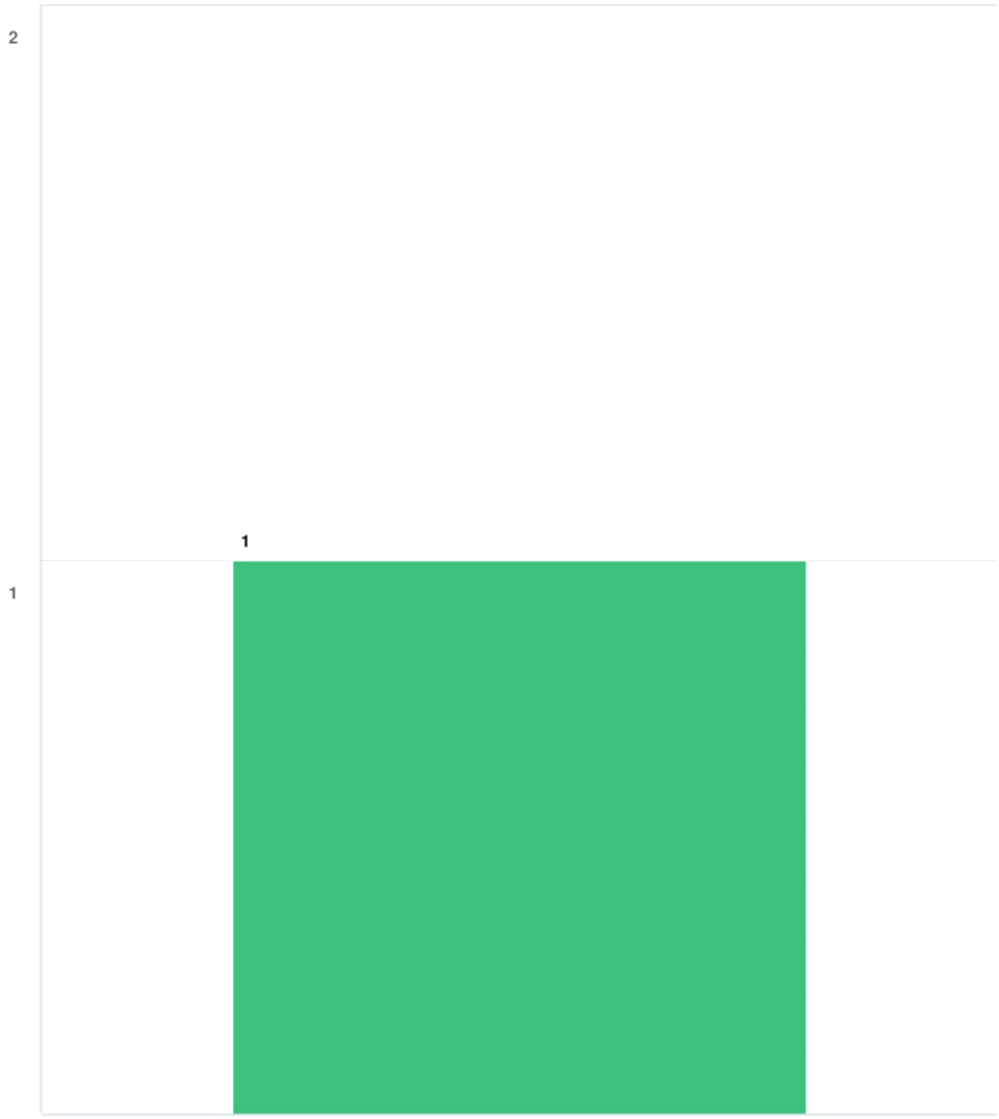


Question options

Significantly

Optional question (1 responses, 5 skipped)

Q22 Evaluate and adapt management actions - Do you think the recommended actions will contribute to the vision and management objectives?



Question options

Somewhat

Optional question (1 responses, 5 skipped)

Q23 Do you have any further comments relating to any of these management strategies?

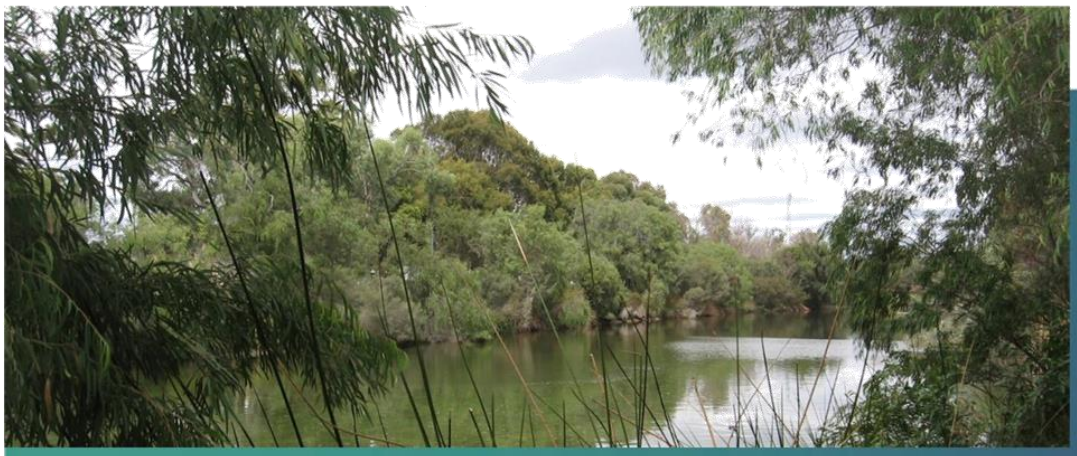
John McCallum 2/01/2019 05:31 PM	I think it is important to provide some evaluation and science behind the eventual removal of sediment in sections of the waterway.
rmc 2/07/2019 01:04 PM	The controls used by the City (herbicide i presume) for the control of Hydrocotyle bonariensis have not been successful. I think that this is a sleeper weed, and I think we should expect an explosion - lots of germinations. I am surprised that this has not happened already, but instead, the plant is spreading vegetatively through vigorous root action.
Harpam 2/25/2019 12:46 AM	Evidence based: Coastal sand accretion commenced about 3000 yrs ago and will continue .Accretion appears to have accelerated these past 10 yrs and in your lifetime Toby's will lose contact with the ocean altogether. Current visions and goals and their approach is 1st class. But irrefutable historical evidence strongly suggests the effects will be temporary , resulting in much wasted resources wasted . Extreme pity but inevitable .

Optional question (3 responses, 3 skipped)

Department of Water and Environmental Regulation
Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Lower Vasse River Waterway Management Plan

Draft for public comment



City of Busselton
Geographe Bay

Revitalising Geographe Waterways

VASSE taskFORCE

4.3 Water treatment using specialised clays

"Water treatment trials" in the Lower Vasse River have focussed on specialised clays. Covering the sediments with specially-developed material can prevent nutrient release and reduce nutrients available for algal growth. These products are applied as a slurry and settle through the water column to form a layer on the surface of the sediments. Applied in this way, these products can bind to and sink nutrients and algal cells as they settle through the water column (Figure 16). There are a number of clay products used commercially and experimentally in a global context. Three have been trialled in the Lower Vasse River: Phoslock™, flocculating clays, and hydrotalcite clay.

From 2001-2004, three trials of Phoslock™ were completed. Application during an existing algal bloom can substantially reduce available phosphorus but had no effect on the algal bloom. Application prior to establishment of the algal bloom reduced both phosphorus levels and limited algal growth by 80%, although a less severe algal bloom still occurred (Robb et al. 2003). Application rates for Phoslock™ are well-understood and it is a commercially available product. It needs to be applied prior to establishment of an algal bloom, to restrict growth by reducing phosphorus availability.

Two types of flocculating clays have been trialled in the Lower Vasse River. Application of a clay mixture containing polyaluminium chloride in April 2000 had no overall positive effect on river appearance. An experimental clay product was applied to a small contained area in February 2002, which did show visible improvement in water quality, but little monitoring was done.

Hydrotalcite clay (HT clay) has been the focus of more recent trials in the Lower Vasse River. Like Phoslock, this product is applied as a slurry and designed to strip phosphorus from the water column and trap phosphorus by forming a layer on the sediment surface. A mesocosm study was undertaken during 2006-17; followed by a larger scale field experiment in 2017-18. The results of these trials indicate reductions in phosphorus concentrations and algal growth (DWER 2018c). Unfortunately observed water quality remained poor in the trial areas, with the water still having a green appearance. More work is required to determine appropriate dosage levels, and this product is not widely available.

In general terms, these products have not demonstrated prevention of algal blooms, but have shown some success in reducing algal growth. Their effectiveness is limited by ongoing external nutrient inputs, so ongoing applications are needed and they are costly. DWER currently recommend annual treatment of the lower reach of the river with PhoslockTM , at an estimated cost of $120,000 per year.

Targeted treatment may be possible in smaller, seasonally-isolated areas following implementation of living streams works. This would make multiple applications more affordable. An ongoing interest in future development of these products should be maintained as they are improved and developed commercially.

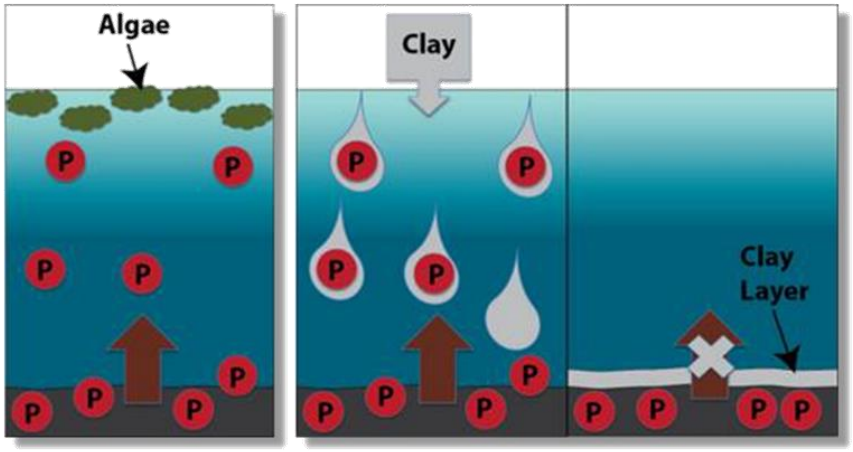


Figure 16. Phosphorus-binding clay products such as Phoslock® or the new HT-clay lock up phosphorus, making it unavailable to algae. Phosphorus is removed as the clay settles through the water and it also forms a protective layer on the sediments, reducing phosphorus release. Figure Courtesy DWER.

Figure 17. HT clay being applied in the Lower Vasse River during the 2017-18 trial.

4.4 Water treatment using microbiological products

A number of commercial products exist that claim to improve water quality through the introduction or enhancement of micro-organisms. There are no scientific studies available on the effectiveness of these products. Current evidence is anecdotal only and while some benefits may have been observed in small-scale situations they have not been formally reported.

The City supported trials of two such products in the Lower Vasse River during the summer of 2012-2013: *The Water Cleanser* and *Soil Zyme.* Water quality variables were monitored at fortnightly intervals throughout these trials within treated mesocosms, untreated mesocosms and in open waters upstream and downstream.

The Water Cleanser (TWC) is described as a microbiological culture pad that provides high surface area and trace elements to increase the population of beneficial microbes (Archaea microbes and Bacillus bacteria) (information provided by manufacturer MEC). Enhanced nitrification and denitrification is described as the beneficial process for improving water quality. Water quality monitoring did not show any significant effects of this treatment. There may be potential for further research in partnership with Curtin University for this product.

Soil Zyme contains an enzyme protein designed to promote bacterial growth and activity. Water quality monitoring found lower pH and oxygen levels in treated waters during the trial. After three months, increasing nitrate plus nitrite and ammonia observed. This does suggest enhanced ammonification and nitrification, but there may have been limited loss from the system via denitrification (to produce nitrogen gas). This product may influence the phytoplankton community by increasing available nitrogen. The Lower Vasse River generally has very low available nitrogen, which favours blue green algae that can obtain nitrogen from the atmosphere through fixation. Reducing phosphorus availability is very important for limiting algal growth, and these products do not achieve this.

These trials did not take place under conditions of severe algal blooms normally experienced in this section of the river at this time of year, so visual effects on algal blooms could not be assessed. The proliferation of Mexican waterlily in downstream parts of the river had an effect of limiting the algal bloom in the upstream reach including the treatment area.

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Department of Water and Environmental Regulation
Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Lower Vasse River Waterway Management Plan

May 2019

City of Busselton
Geographe Bay

Revitalising Geographe Waterways

VASSE taskFORCE

4.3 Water treatment

Reducing nutrient inputs is a fundamental management approach, but significant reduction in nutrient loading from diffuse sources in the catchment is difficult to achieve and takes many years. In highly eutrophic systems, such as the Lower Vasse River, reducing nutrient inputs alone is unlikely to prevent algal blooms because of the ongoing supply of nutrients form the sediments. Intervention options to limit nutrients available to algae and to treat algal blooms may be necessary to achieve short term water quality improvement. The main limitations of these options are uncertainty in effectiveness, costs of large scale treatment, and short-term effectiveness.

4.3.1 Water treatment using specialised clays

"Water treatment trials" in the Lower Vasse River have focussed on specialised clays. Covering the sediments with specially-developed material can prevent nutrient release and reduce nutrients available for algal growth. These products are applied as a slurry and settle through the water column to form a layer on the surface of the sediments. Applied in this way, these products can bind to and sink nutrients and algal cells as they settle through the water column (Figure 17). There are a number of clay products used commercially and experimentally in a global context. Three have been trialled in the Lower Vasse River: Phoslock™, flocculating clays, and hydrotalcite clay.

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Targeted treatment may be possible in smaller, seasonally-isolated areas following implementation of living streams works. This would make multiple applications more affordable. An ongoing interest in future development of these products should be maintained as they are improved and developed commercially.

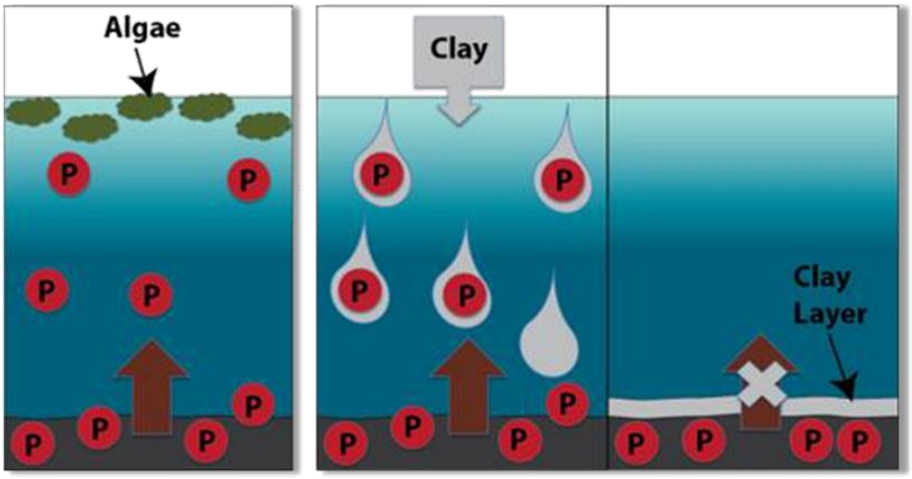

Figure 17. Phosphorus-binding clay products such as Phoslock® or the new HT-clay lock up phosphorus, making it unavailable to algae. Phosphorus is removed as the clay settles through the water and it also forms a protective layer on the sediments, reducing phosphorus release. Figure Courtesy DWER.

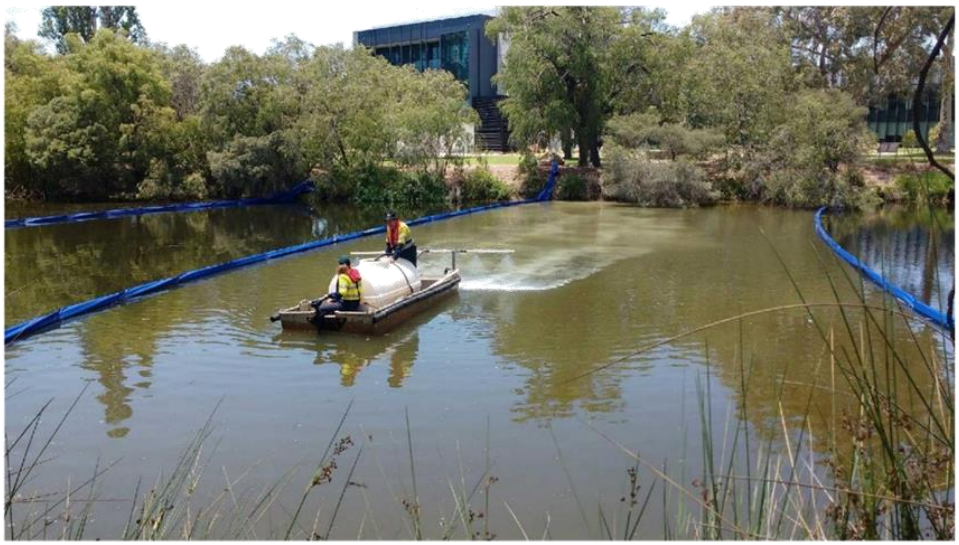

Figure 18. HT clay being applied in the Lower Vasse River during the 2017-18 trial.

4.3.2 Oxygenation and aeration

Oxygen is important for aquatic fauna and also influences nutrient availability. Low oxygen levels can be artificially increased by pumping oxygen gas into the water and by aeration. Both these methods will result in increased oxygen levels in the water, although oxygenation is more effective and aeration may increase nitrogen concentrations (due to nitrogen content of air).

Increasing oxygen levels improves conditions for aquatic fauna and promotes aerobic biological processes, which can address odour issues.

Low oxygen conditions at the bottom of the water facilitate release of phosphorus from the sediments, which contributes to algal blooms (Boulton et al. 2014). This situation occurs when there is little mixing and the water column is stratified. In this situation, oxygenation, aeration or artificial circulation can reduce phosphorus release from sediments into the water.

The Lower Vasse River is not stratified, and has high oxygen levels throughout the water column during summer when the algal bloom is established. Algal blooms increase oxygen levels to above 100% during the day through photosynthesis. Although respiration at night consumes oxygen, it does not cause deoxygenation. The water is shallow enough to be mixed by the wind. Oxygenation and aeration of the water column would therefore not address nutrient problems in the Lower Vasse River when an algal bloom is established. The sediment is anoxic, but these methods do not oxygenate the sediments, and an attempt to do so would cause considerable resuspension of sediments.

Oxygenation was trialled in the Lower Vasse River during the summer of 1998-99 to determine the effectiveness of the process and water quality outcomes. There was no effect on the established algal bloom, although increased oxygen levels were observed and considered beneficial for aquatic fauna. Greater understanding of oxygen fluctuations prior to the onset of the algal bloom when oxygen levels would help assess potential advantages of oxygenation lower in the Lower Vasse River.

In addition to increasing oxygen levels, mixing of the water through aeration combined with sufficient circulation may influence algal growth by reducing the residence time. Phytoplankton thrive in the still conditions of the Lower Vasse River during summer. Movement of water within the system has potential to limit algal blooms by physical disturbance and reducing water temperatures (Cha et al. 2017). Artificial mixing is a common management practice in lake restoration, both to address stratification problems and to restrict growth by entraining phytoplankton in flow, and can restrict growth of scum-forming blue-green algae (Visser et al. 2016).

4.3.3 Water treatment using microbiological products

A number of commercial products exist that claim to improve water quality through the introduction or enhancement of micro-organisms. There are no scientific studies available on the effectiveness of these products. Current evidence is anecdotal only and while some benefits may have been observed in small-scale situations they have not been formally reported.
The City supported trials of two such products in the Lower Vasse River during the summer of 2012-2013:

- A microbiological culture pad product that provides high surface area and trace elements to increase the population of beneficial microbes (*Archaea* microbes and *Bacillus* bacteria).
- An enzyme protein product designed to promote bacterial growth and activity.

Water quality monitoring over three months did not show any significant effects of these treatments, however there were several limitations of the trials. There was no aeration, which is generally recommended in combination with these treatments. The trials did not take place under conditions of severe algal blooms expected, owing to the effect of Mexican waterlily downstream.

Enhanced nitrification and denitrification is described as the beneficial process by which these products improve water quality, and some effect on available nitrogen was found for the enzyme product. The Lower Vasse River generally has very low available nitrogen, which favours blue green algae because they can obtain nitrogen from the atmosphere through fixation. This product may influence the phytoplankton community by increasing available nitrogen. Reducing phosphorus availability is very important for limiting algal growth, and these products do not achieve this.

There are no published studies of the effective use of microbiological products to control algal blooms at the lake scale. They may be more effective in small isolated systems such as ponds and dams.

4.3.4 Barley Straw

Addition of barley straw is considered a preventative method for algal control that has been used extensively in farm dams and canals. Decomposing straw has been shown to inhibit algal growth in laboratory conditions (Gibson et al. 1990) and reduce filamentous algal growth in canals in years following placement (Welch et al. 1990). Barley straw bales and extracts are marketed for use in algae prevention.

In April 2000, straw bales were placed in the Lower Vasse River upstream of the Causeway Rd bridge to assess their effect on algal blooms. No effect on water quality was observed, however it is uncertain that Barely straw was used. Potential future use should consider it may be most effective at small scales; in a preventative approach; and that straw must be decomposing. It may be more effective for filamentous algae rather than phytoplankton.

4.3.5 Algaecides

A number of algaecides are marketed for treating algae, usually copper-based, but are generally not recommended for natural systems due to their toxicity to non-target plants and aquatic fauna. Hydrogen peroxide is marketed as an algaecide which has high specificity for blue-green algae and no residual impacts on the environment as it breaks down to hydrogen and oxygen gases. Some research supports its potential as a management tool for algal blooms (Matthijs et al. 2012, Bauza et al. 2014). It has been used to control blue-green algae in small lakes and wastewater treatment ponds, but is not widely used for larger systems for a number of reasons:

- difficulty in achieving and maintaining required concentrations throughout water body;
- potential impact of hydrogen sulphide on other organisms, mainly zooplankton;
- potential for release of toxins such as microcystins from dying algal cells;
- lack of residual effect (regrowth of algae following treatment).

Trials of hydrogen peroxide in Lake Torrens[4] in South Australia have not been formally reported. Information provided suggests effective reduction of blue-green algae at H_2O_2 concentrations of 2-5 mg/L, with no impacts on aquatic fauna. However these trials were conducted at low algal cell densities (below algal bloom levels), and the current recommendation is for small scale use in combination with other methods. SA Water continues to investigate this method for reservoir management.

[4] Information from unpublished report and discussions with local NRM group Natural Resources Adelaide and Mt Lofty Ranges.

4.3.6 Ultrasound

Ultrasonic control of phytoplankton is commonly used for pond environments and works by destruction of algal cells. Its effectiveness has been demonstrated in small scale studies and laboratory experiments, but upscaling this treatment to field conditions is challenging (Park et al. 2017). Frequency, intensity and exposure are important factors in effectiveness, and may have variable effects on different algal species. There has been a successful trial in a 9000m^3 pond in combination with pumping, but could not differentiate the effects of ultrasound and the pumps (Ahn et al. 2007).

Figure 19. Improving riparian revegetation through weed control and infill planting.

Figure 20. Floating island on the Lower Vasse River installed in 2002.

13.2 Local Planning Scheme 21 - Report of Review

SUBJECT INDEX:	Review and Consolidation of local planning schemes
STRATEGIC OBJECTIVE:	Planning strategies that foster the development of healthy neighbourhoods that meet our needs as we grow.
BUSINESS UNIT:	Strategic Planning
ACTIVITY UNIT:	Strategic Planning
REPORTING OFFICER:	Manager, Strategic Planning - Matthew Riordan
AUTHORISING OFFICER:	Director, Planning and Development Services - Paul Needham
VOTING REQUIREMENT:	Simple Majority
ATTACHMENTS:	Attachment A Development Control Framework - Review and Proposed Direction (Report to Council 26 April 2017)

PRÉCIS

This report seeks Council consideration of a required report of review for Local Planning Scheme 21 (Scheme). It is recommended that the Council recommend to the Western Australian Planning Commission (WAPC) that the Scheme does not need to be repealed and replaced, but does need to be amended. The report also sets out a proposed approach to amending the Scheme.

BACKGROUND

A local government must carry out a review of its local planning scheme in the fifth year after the scheme was first gazetted. The local government must then forward the results of its own review (in the form of a 'report of review' – and this report to the Council is intended to fulfil that purpose) to the WAPC within 6 months of the commencement of that fifth year. The WAPC then considers the report of review, and advises whether it agrees with the local government's recommendation or not.

As the Scheme was first gazetted on 15 October 2014, the fifth year commenced on 15 October 2018. The report of review was therefore due to be provided to the WAPC by 15 April 2019. Should the Council support the officer recommendation, the City would be able to provide the report within a month or so of that date.

Fundamentally, the report of review must make one of three possible recommendations –

1. The Scheme is satisfactory in its current form;
2. The Scheme should be amended; or
3. The Scheme should be repealed and a new scheme prepared in its place.

Where a local government has an adopted local planning strategy (LPS), the report of review must make similar recommendations about the LPS. The City does not, however, have an adopted LPS. The Council-adopted draft LPS has been pending final WAPC determination since late 2016.

In a report considered and endorsed at the Council's Ordinary Meeting of 26 April 2017 (Attachment A), which was drafted in substantial part in preparation for the then upcoming review, the Council considered and endorsed a proposed approach to reviewing and updating the development control framework for the City (including the planning framework). The endorsed approach at that time recognised that the Scheme was not satisfactory in its current form, but that it should be amended, rather than being repealed and replaced. Significant progress has been made in implementing Council's 2017 resolution, in particular through a series of omnibus amendments to the Scheme.

STATUTORY ENVIRONMENT

The key statutory environment is set out in the *Planning and Development (Local Planning Schemes) Regulations 2015* (the Regulations), principally Regulations 65-67. The most important elements of that statutory environment, because they are so fundamental to the issues addressed in this report, were outlined in the preceding, 'Background', section of this report.

Also of note from the statutory environment is that a local planning scheme amendment process (e.g. an amendment to 'rezone' land), if it has not been substantially completed prior to the subject scheme being repealed and replaced (and the amendment can then be 'rolled-in' to the new scheme prior to its gazettal), must be recommenced as an amendment to the new scheme (so elements of the process already undertaken must be repeated). That is somewhat problematic, as it can either result in pressure to defer gazettal of the new scheme until such time as the amendment is ready to be 'rolled-in' to the new scheme, or the proponent, local government and State agencies must bear the costs and complications associated with going through the amendment process again (which might be somewhat simpler, as the substantive issues should have already been addressed, but will nevertheless come at a cost in both time and resources, and if the issues are controversial, will not necessarily prevent further controversy).

Importantly, regulation 65(2) also sets out information that must be included in the report of review, as follows –

(a) the date on which the local planning scheme was published in the Gazette in accordance with section 87(3) of the Act;

(b) the date on which each amendment made to the scheme was published in the Gazette in accordance with section 87(3) of the Act;

(c) the date on which the scheme was last consolidated under Part 5 Division 5 of the Act;

(d) an overview of the subdivision and development activity, lot take-up and population changes in the scheme area since the later of —

  (i) the date on which the scheme was published in the Gazette in accordance with section 87(3) of the Act; and

  (ii) the date on which the scheme was last reviewed;

(e) an overview of the extent to which the scheme has been amended to comply with the requirements of any relevant legislation, region planning scheme or State planning policy.

That information, plus some other relevant information, is set out below -

a) The Scheme was published in the Gazette on 15 October 2015.

b) (i) The following amendments have been published in the Gazette -

Amendment Number	**Date of Publication in Gazette**	**Property/Purpose of Amendment (Summary Overview)**
AMD21/0007	16 June 2015	Lot 376 Kent Street and Lot 309 Prince Street, Busselton - rezoning from 'Reserve for Recreation' to 'Business'.
AMD21/0002	17 July 2015	Lot 1 (12) Little Colin Street, Broadwater (Cape View Apartments) - introduce Special Provision 56 (SP56) to permit 25% permanent occupancy.
AMD21/0012	11 December 2015	Lot 1992 Downs Road Ludlow - rezone portion from 'Agriculture' to 'Bushland Protection'.

Amendment Number	Date of Publication in Gazette	Property/Purpose of Amendment (Summary Overview)
AMD21/0009	5 February 2016	Lot 37 (62) West Street, Busselton (Busselton Squash Courts) - introduce Additional Use 80 (A80): 'Office' and 'Residential'.
AMD21/0016	24 March 2016	Lot 200 (44) Bell Drive, Broadwater (Aegis Aged Care Group) - rezone from 'Residential (R20)' to 'Residential (R40)'.
AMD21/0006	27 May 2016	Lot 3 (500) Bussell Highway, Broadwater - rezoning from 'Special Purpose (Drive-in)' to 'Special Purpose (Broadwater Development Area)' and 'Reserve for Recreation'.
AMD21/0017	19 August 2016	Lot 2761 (29) Commonage Road, Quindalup (Dunsborough Lakes Caravan Park) - introduce Special Provision 60 (SP60) to permit 15% unrestricted length of stay.
AMD21/0013	23 September 2016	Rezoning various lots from 'Residential (R20)', 'Tourist' and 'Reserve' to 'Conservation' and revise the Broadwater Structure Plan accordingly.
AMD21/0015	2 December 2016	Lot 4001 (251) Metricup-Yelverton Road, Yelverton – rezoning from 'Agriculture' to 'Bushland Protection'.
AMD21/0001	4 August 2017	Omnibus amendment 1 – various land use permissibility and interpretation changes (including the addition of new land uses), changes to height requirements, introduction of Additional Use 74 (A74) of 'Guesthouse', 'Medical Centre', 'Office', 'Professional Consulting Room's, 'Restaurant/Café', 'Shop' and 'Tourist Accommodation' to residential-zoned lots on the fringes of the Busselton and Dunsborough Business zones, including a requirement for urban design guidelines to be prepared - as well as various other scheme text and map refinements and corrections.
AMD21/0010	1 September 2017	Introduce a requirement to obtain development approval for development comprising 're-purposed dwellings' and 'second-hand dwellings'.
AMD21/0023	1 September 2017	Lot 9507 Layman Road Geographe – replacing unzoned road layout with 'Residential' zone and residential density consistent with adjoining residential land (R20 and R30), and introduction of a small parcel of 'Reserve for Recreation'.
AMD21/0018	22 December 2017	Lots 4 & 318 Layman Road, Wonnerup – rezone from 'Agriculture' to 'Conservation' and 'Reserve for Recreation'.
AMD21/0020	22 December 2017	Lot 500 Bussell Highway, Broadwater - rezoning from 'Tourist' to 'Residential (R40)' and 'Reserve for Recreation (Highway Buffer)'. Lot 502 Bussell Highway, Broadwater – rezoning from 'Tourist' to 'Residential (R40)', 'Reserve for Recreation

Amendment Number	Date of Publication in Gazette	Property/Purpose of Amendment (Summary Overview)
		(Highway Buffer)' and 'Unzoned Land (Road Reserve)'. Introduction of Special Provision area 62 (SP62) of 'Residential (R40)', requiring a structure plan being prepared for portions of Lot 500 and Lot 502 prior to any application for subdivision.
AMD21/0035	2 February 2018	Align a number of land use terms within the Scheme to the Model Provisions (Basic Amendment).
AMD21/0025	23 March 2018	Omnibus amendment 2 - an amendment to further align the Scheme with the Deemed Provisions of the Planning and Development (Local Planning Schemes) Regulations 2015.
AMD21/0027	29 June 2018	Lot 10 Commonage Road, Dunsborough - rezoning from 'Reserve for Public Purposes' to 'Special Purposes (Dunsborough Lakes Development Area)'
AMD21/0011	24 August 2018	Lot 201 Balmoral Drive, Quindalup - rezoning portion of lot from 'Rural Residential' to 'Reserve for Public Purpose' and to modify the boundary of Additional Use 37 (A37) and add 'Restaurant' as an additional permissible use.
AMD21/0034	8 March 2019	Lot 34 Sheoak Drive, Yallingup – removal of Additional Use 39 (A39) of 'Community Centre, Child Care Centre, Recreation Facility, Art & Craft Studio, Rural Holiday Resort, Private Recreation, Licensed Restaurant, Reception Centre and Shop (having a gross leasable area of 150m^2)'.

(ii) The following amendments have been subject of resolutions to prepare, but not yet published in the Gazette -

Amendment Number	Date of Resolution to Prepare and current stage in process	Property/Purpose of Amendment (Summary Overview)
AMD21/0021	Initiated 12.4.2017 (Ministerial decision received; gazettal imminent)	Lot 11 and Pt. Lot 803 Chapman Hill Road, Busselton. Consolidate SP Areas 47&48 to shift focus from motor vehicle and marine sales to conventional light industrial and service commercial.
AMD21/0028	Initiated 24.4.2018: consent to advertise for public consultation expected after consideration at SPC in May or June, 2019.	Introduction of consolidated and Regs-compliant development zone provisions into scheme, including new 'Urban Development', 'Industrial Development' and 'Vasse Townsite' zones. Align various 'development zone provisions' in Schedule 3 of scheme with Regs. Remove development investigation areas and 'hard zone' subdivided and developed areas.

Amendment Number	Date of Resolution to Prepare and current stage in process	Property/Purpose of Amendment (Summary Overview)
AMD21/0029	Initiated 13.12.2017 (Ministerial decision received; Gazettal imminent)	Broadly align scheme with Model Provisions (zones & zone objectives, including 'Drive-Through Exclusion Area' to 'Drive-Through Facility Control Area', and structure plan area for Dunbarton.
AMD21/0036	Initiated 24.4.2018; held in abeyance pending EPA assessment advice. Yet to be advertised for public consultation.	'Vasse East' land strategically identified in draft LPS (2016) and draft LNSRS for urban growth and development. Rezoning from 'Agriculture' and 'Rural Residential' to 'Urban Development'.
AMD21/0037	Initiated 30.1.2019 (currently being advertised for public consultation until 29.5.2019).	Lot 7 Forrest Beach Road, Wonnerup: rezoning from 'Agriculture' to 'Conservation', 'Reserve for Recreation' and 'Reserve for Public Purposes (Water Tank)'. Amendment will facilitate subdivision into 6 lots through auspices of subdivision incentives in Busselton Wetlands Conservation Strategy
AMD21/0038	Initiated 8 May 2019. To be advertised for 42-days in May-June 2019.	Introduction of Additional Use 82 in Schedule 2 of scheme to provide permissibility for following land uses: restaurant, winery, brewery, produce sales and chalet.
AMD21/0039	Initiated 24.4.2019. Referred to EPA for assessment ahead of public consultation.	Removal of redundant Special Provision 33 (relating to both subject Lot 202 Bussell Hwy and abutting lot 201 Seymour Street). Former 'split-zoning' (R40-60) amended to R40 (Lot 202) and R40 (Lot 201).
AMD21/0042	Initiated 10.4.2019. Referred to EPA for assessment advice ahead of public consultation.	Introduction of new clause in Part 5 'Special Control Areas' of scheme, viz: 'Western Ringtail Possum Habitat Protection Areas'

(iii) The following further amendments have not yet been subject of resolutions to prepare, but are considered to have a high likelihood of being presented to the Council with a City officer recommendation supportive of a resolution to prepare -

Amendment Number (0000 if not yet allocated)	City or external proponent?	Property/Purpose of Amendment (Summary Overview)
AMD21/0014	City	Airport Protection Zone (awaiting further noise modelling, following final Minister for Environment decision on Noise Management Plan).
AMD21/0030	City	Implementation of recommendations of adopted planning strategies (post-LNSRS publication) and better alignment of scheme with SPPs.

Amendment Number (0000 if not yet allocated)	City or external proponent?	Property/Purpose of Amendment (Summary Overview)
AMD21/0031	City	Focus on improvement and rationalisation of Part 4 'General Development Requirements' and Part 5 'Special Control Areas' of the scheme.
AMD21/0032	City	Further addressing detailed mapping issues, along with consolidation/refinement of Schedule 2 'Additional Uses' and Schedule 3 'Special Provision Areas'
AMD21/0033	City	Review of residential density provisions in the scheme and consideration of justifiable up-codings in alignment with draft LPS (2016). Review of 'Special Character Area' provisions, together with current density concessions available through the scheme.
AMD21/0034	City	Addressing issues around rural land use and development provisions.
AMD21/0040	City	Review of Zoning Table in specific respect to retail land-uses outside centre zones
AMD21/0000	External	Potential rezoning(s) to accommodate land use and development at Lot 683 Cape Naturaliste Road and Lot 203 Bunker Bay Road, Bunker Bay.
AMD21/0000	External	Various landholdings in the ownership of the D'Espeissis family where scheme amendment(s) involving boundary adjustments, land transfers into reserves. Potential rezonings to allow concomitant development rights. Subject land includes West Dunsborough and across Cape Naturaliste.
AMD21/0000	External	Lots 23 and 41 Causeway Road, Busselton. Rezoning options from current (and probably redundant) zoning of 'Tourist'.
AMD21/0000	External	Rezoning of 'Conservation' zoned land to 'Residential' at/near Nilgup Park, Broadwater following re-consideration by landowner(s) and family (Broadwater Structure Planning to be rationalised and unified in parallel).
AMD21/0000	External	Returned Services League-owned land at Lot 69 Rosemary Drive, Busselton ('Residential R30') to be re-developed with adjoining Lots 48 & 49 Causeway Road ('Tourist') and Lot 100 Southern Drive (Residential R30') with a variety of appropriate land uses to cater for veterans in a 'regional hub'.
AMD21/0000	External	Rationalisation of zonings and redundant Additional Uses in complex land holdings at Commonage in 'Millbrook Estate'.
AMD21/0000	City	Amendment in parallel with targeted review and rationalisation by the City of dated structure plans and 'Rural Residential' (et al) zonings across the Commonage Policy Area Consolidated Structure Plan area.

Amendment Number (0000 if not yet allocated)	City or external proponent?	Property/Purpose of Amendment (Summary Overview)
AMD21/0000	City	Targeted consolidation and rationalisation of zonings across Dunbarton 'Rural Residential' area, especially sewer-sensitive areas, with up-zonings to low-density residential (e.g. 'Residential R5') and urbanised zones such as at 'Vasse East'.
AMD21/0000	External	'Tourist'-zoned land at eastern Provence, Yalyalup rezoned to 'Urban Development'.
AMD21/0000	External	Amendment to Dunsborough Lakes Structure Plan for Lot 9050 Clubhouse Drive from 'Tourist' to 'Residential'. Along with other considerations and potential options.

c) The Scheme has not been consolidated in accordance with the formal requirements of Part 5, Division 5 of the Planning and Development Act 2005. Note this is a requirement that arises in parallel with the scheme review requirement, if a new scheme is not being prepared.

d) The following is a summary of development activity and population growth since the Scheme was first published in the Gazette -

Financial Year	# of subdivision approvals issued	# of property titles created	# of building permits issued for new dwellings	Estimated resident population (District)
2014-2015	79	505	666	35,917 (2014 ABS ERP)
2015-2016	43	458	561	36,940 (2015 ABS ERP)
2016-2017	51	456	505	36,686 (2016 Census) / 37,776 (2016 ABS ERP)
2017-2018	29	336	478	38,375 (2017 ABS ERP)
2018-2019	18	228	264 (to end Feb 2019)	38,926 (2018 ABS ERP)

e) There is no relevant region planning scheme. Amendments to the Scheme have been variously published in the Gazette (Amendments 1 and 25) substantially with the aim of bringing the Scheme into consistency with the Regulations, and further amendments to those ends have been subject of a resolution to prepare, but has not yet been published in the Gazette (Amendments 21, 28 and 29). Further amendments to similar ends, as well as achieving consistency with State planning policy, are also planned, as set out at Attachment A and point (b) (iii) above.

RELEVANT PLANS AND POLICIES

There are an extensive range of plans and policies that have been considered in preparing this report, including -

1. City of Busselton Community Strategic Plan 2017
2. Draft City of Busselton Local Planning Strategy 2016
3. City of Busselton Local Commercial Planning Strategy 2011
4. City of Busselton Local Rural Planning Strategy 2007

5. City of Busselton Local Environmental Planning Strategy 2011
6. City of Busselton Local Tourism Planning Strategy 2011
7. City of Busselton Local Cultural Planning Strategy 2011
8. Busselton City Centre Conceptual Plan 2014
9. Dunsborough Town Centre Conceptual Plan 2014
10. City of Busselton Local Planning Policy Manual
11. South West Planning and Infrastructure Framework (WAPC, 2015)
12. South West Regional Blueprint (SWDC, 2014)
13. Draft Leeuwin-Naturaliste Sub-Regional Planning Strategy (WAPC, 2018)
14. State Planning Policies (various dates)

FINANCIAL IMPLICATIONS

The review and updating of the City's development control framework will require continued and significant investment. Some of the work required has been, and to some degree continues to be, deferred because there has been no final WAPC decision regarding the City's LPS. Nevertheless, the City has been undertaking a range of initiatives to review and update our development control framework, including amendments to the Scheme, reviews of structure plans, local planning policies and developer contributions arrangements, the development of activity centre plans and the City's coastal adaptation strategy (or 'CHRMAP' – Coastal Hazard Risk Management and Adaptation Plan).

To allow that work to continue, the City will need to continue to allocate significant officer resources but also, in future years, allocate additional funds to obtain specialist external advice and assistance. Some additional funds were able to be allocated for the current budget year, and the Council has informally indicated (through the most recent Long-Term Financial Plan review process), a willingness to support a further increase for 2019/20.

LONG-TERM FINANCIAL PLAN IMPLICATIONS

There are no long term financial plan implications of the recommendations of this report, other than those noted above.

STRATEGIC COMMUNITY OBJECTIVES

The recommendations of this report reflect strategic Community Objective 2.1 of the City of Busselton Strategic Community Plan 2017; "Planning strategies that foster the development of neighbourhoods that meet our needs as we grow".

RISK ASSESSMENT

An assessment of the risks associated with implementation of the officer recommendation has been undertaken against the City's risk assessment framework. No significant risks have been identified. The risks of preparing a new scheme, however, are considerable, as other processes to amend the scheme would be seriously affected, having a considerable impact on the planning authorities' abilities to manage the practical planning and development issues that arise in such a diverse, dynamic and fast-growing part of WA.

CONSULTATION

Actions required to implement the WAPC's decision in this matter (which would entail either amendments to the Scheme, or its repeal and replacement) would involve consultation, reflecting amongst other things statutory requirements for such consultation. Given the nature of the decision(s) yet to be made, however, it has not been considered necessary to undertake consultation in the preparation of this report.

OFFICER COMMENT

This report of review must make one of three possible recommendations –

1. The Scheme is satisfactory in its current form;
2. The Scheme should be amended; or
3. The Scheme should be repealed and a new scheme prepared in its place.

It is clear and the Council has already endorsed the position that the Scheme is not satisfactory in its current form. As such, there are two possible recommendations – that the Scheme be amended, or that the Scheme be repealed and a new scheme prepared in its place. In either case, it is considered clear that substantial change is required. That is in terms of the Scheme itself, as well as with respect to various subsidiary elements of the City's broader planning and development control framework, including Structure Plans, Local Planning Policies and Local Laws.

Making that task very challenging is the fact that the City of Busselton, by dint of the diversity of the District, has one of the most diverse and complex sets of planning issues of any local government in WA. Added to that, is the considerable and progressive, historical 'accretion' of the local planning framework. That means that the City has one of the most complex planning frameworks of any local government in WA. There are, for example, over 450 Structure Plans, Local Development Plans or similar that relate to land in the District. Further, within the Scheme itself, there are 80 different Additional Use designations and 62 sets of Special Provisions. The age, quality, conceptual basis and presentation of these planning instruments is also often inconsistent.

Rationalising and consolidating this complex framework is no doubt necessary and important; including to better align the City's framework with the overarching State framework (it is worth noting, though, that the City's Scheme is currently fairly closely aligned with the current, overarching State framework, and will be even more so once Amendments 21, 29 and 28 have been published in the Gazette). In doing so, there will no doubt be a need to change and in many cases standardise the substantive planning outcomes. That is both to align with the overarching State framework, but also because it will simply not be possible to consolidate the framework whilst retaining all of the idiosyncrasies that some may think are important.

Choosing just one seemingly fairly banal example, the approaches to control of fencing and building envelopes in rural-residential areas are often inconsistent. Some property owners are very supportive of controls which prohibit boundary fencing in some areas, and which specify building envelopes, whereas others are not supportive, and are strongly in favour of retaining the more liberal approaches adopted in some other areas. The community would expect that there would be consultation before there is a change of substantive planning direction with respect to these kinds of issues. There are a host of similar examples.

Considerable technical investigations and stakeholder consultation will also be required before many of the required changes can, in fact, be made. It is one thing to identify that a change is required, it is often quite another to work out exactly what that change is seeking to achieve and how that should be best reflected in the planning framework. For example, it is known that the current Landscape Value, Coastal Management and Floodway Special Control Area designations and associated controls

in the Scheme are no longer entirely appropriate. But the work to identify exactly what areas should be given such designations and exactly what controls might best apply in areas subject of them is considerable. To take just one of those examples, identifying the right changes to make to the Coastal Management Special Control Area requires, possibly amongst other things, the prior completion of the City's Coastal Hazard Risk Management and Adaptation Plan (CHRMAP).

If such changes are to be effected through preparation of a new scheme, the technical investigations and stakeholder consultation associated with making all changes must be undertaken before the new scheme can actually be prepared and finalised. The result is that an issue that needs to be addressed, and where the work has been done to work out what needs to be done to address that issue, does not actually get addressed until all of the work has been done to address all of the other issues. That in turn means that many issues go unaddressed for longer than would otherwise be necessary. The same problem would not arise to anywhere near the same degree if a new scheme does not have to be prepared and, instead, the Scheme is updated through a series of amendments.

An alternative might involve the preparation of a new scheme which does not seek to address all of the issues and instead only addresses those issues where the technical investigations and stakeholder consultation have been done, or can be done relatively simply. More difficult issues would then be addressed through subsequent amendments to the new scheme. It is not entirely clear, though, what that would achieve. It would also mean that both City-driven and externally-driven amendments could not proceed in the normal fashion for some period of time. Also of note is that, at the time of writing, the City does not have an adopted local planning strategy, meaning that a new scheme, were it to be prepared whilst that still remains the case, could not put into effect the strategic direction set out in an adopted local planning strategy. Instead, that would require amendment(s) to the new scheme.

It is understood that the WAPC and Department of Planning, Lands and Heritage officers may have formed the view that updating the Scheme by way of amendments is too complicated. It is certainly true that it is complicated. The complication, however, arises principally because of the diversity of the issues and the complexity of the current framework. It is considered that it may well be no simpler, and possibly even more complicated, to prepare a new scheme. Further, many reductions in complexity that may arise are because some issues would instead need to be addressed through amendments after the new scheme has been prepared, rather than being addressed through the new scheme itself. Leaving those issues unaddressed may also, in and of itself, simply create different kinds of complexity, requiring more complex amendments after the new scheme has been prepared. That essentially leads back to the problem that is being faced currently – which is that any means of updating the scheme looks to be very complicated.

An option which may avoid some of the difficulties with preparing a new scheme, notably the effect on amendment processes during the period in which the new scheme is being prepared, would be to undertake a 'total amendment' of the scheme. That would consist of an amendment which completely replaces all of the current scheme, but not through a new scheme. That would allow for the structure of the scheme to be comprehensively changed to reflect the current State framework. That would also allow, however, both externally-driven and City-driven amendments that require more focused technical investigations and stakeholder consultation to proceed in parallel with the 'new scheme'. This approach is identified as the next best option, after simply amending the Scheme in the more normal fashion. There does not appear to be any statutory impediment to this kind of approach.

If the Council initiated a 'total amendment' of this kind, it would necessarily be a 'complex amendment' and therefore require WAPC consent to advertise. That would provide the WAPC with the same capacity to ensure the completeness of the process as would occur with a new scheme prepared in the more normal fashion. If the WAPC was concerned about its ability to require the Council to actually commence such an amendment, there would seem to be two options available. The first would be asking the Minister to exercise their powers to compel the local government to do so. The second and preferable may be to defer the WAPC decision on the scheme review pending the timely initiation of

such an amendment. Under the legislation, once an amendment or new scheme process has been commenced, it must be followed to its conclusion, which ordinarily is a final decision by the Minister, having considered a recommendation from the WAPC.

Should the WAPC not accept the recommendations of this report, careful consideration would need to be given to managing both amendments already underway, but not yet published in the Gazette, further amendments that are already being contemplated, as well as further amendments that may emerge during the process of preparing a new scheme. When the current Scheme was prepared, there was a 'moratorium' on new amendments, a decision which came into effect with a six month lead time. During that six month period, 17 new amendment proposals were submitted, and the effective moratorium period extended over several years. That resulted in a very significant spike in planning workload for the City, followed by a temporary reduction in workload. Several amendments also failed to be completed before the new scheme came into effect, and the issues that they sought to address remain unresolved to this day. A similar moratorium would be required if a new scheme is to be prepared as a consequence of this report of review, likely resulting in similar workload spikes and falls.

In closing, it is worth providing a critique of the State's current approach to ensuring that local government planning schemes are updated and aligned with the overarching State framework, which to a significant degree consists of the five yearly review requirement. That has been a requirement of WA planning law for several decades, although for much of that time it has not been closely monitored and enforced. Currently, it is a requirement that appears to be more closely monitored and enforced than has often been the case in the past. If the aim is to achieve consistency across the State, though, if not necessarily always in substantive outcomes, but certainly in terms of conceptual basis, structure and format, even the State's current, more pro-active approach looks flawed.

Amongst other things, over a five year period, one would expect the State planning framework to progressively change and evolve. Because local government scheme reviews, however, will arise at different times, the outcomes of each review will reflect the State framework at different points in time. There are other planning jurisdictions that have successfully overcome this problem, by effectively developing a jurisdiction-wide statutory framework, which can be progressively updated by, in WA's case, the State, and where changes are then automatically reflected in local planning frameworks.

In WA, this could be done by (probably progressively) expanding the scope of the deemed provisions. Other than some minor amendments undertaken within 12 months of first Gazettal, however, the Regulations have not been amended since 2015. The Minister could also make greater use of existing powers to require amendment of local planning schemes to comply with new State planning policies or similar. That would mean that even where changes to local planning schemes were necessary to implement changes to the overarching State framework, that could be done in a coordinated way, and the adoption of a new State planning policy would be reflected in all local planning schemes at more or less the same point in time and place in the policy cycle.

The State is already doing this, to a limited degree, through the Residential Design Codes (and their various predecessors), which are progressively updated. Because the Codes are incorporated into local planning scheme by reference, all local planning schemes are then automatically amended to align with changes made by the State. The other key example of where this is already done are the Bushfire risk management controls in the 'deemed provisions' (which form part of the Regulations). Those controls apply automatically throughout WA in areas identified as being in a 'bushfire prone area' by the State. Again, all local planning schemes are effectively automatically amended to align with changes made by the State.

Further, given that the principal problem with preparing a new scheme is that it affects the otherwise normal amendment process, even if the State were not to proceed in the direction briefly articulated above, the State could amend the Regulations such that amendments could continue from one scheme

to another, being integrated into the local planning scheme once the amendment process is complete. In short, the updating of schemes through preparation of new schemes looks to be unnecessary and archaic, adding significantly to the costs and complications of implementing State strategic and policy direction through local planning schemes, and resulting in an overly complicated and disaggregated planning system across WA.

CONCLUSION

It is recommended that the Council accept and endorse this report as the required report of review and recommend to the WAPC that the Scheme be amended, not repealed and replaced.

OPTIONS

The Council could resolve that the Scheme is satisfactory in its current form or that the Scheme be repealed and replaced.

TIMELINE FOR IMPLEMENTATION OF OFFICER RECOMMENDATION

Should the Council make a resolution consistent with the officer recommendation, implementation would consist of forwarding the report of review (i.e. this report and minuted resolution) to the WAPC within two weeks. The WAPC would have 90 days in which to consider the Council recommendation and either agree, or disagree, with that finding and so advise the City.

OFFICER RECOMMENDATION

That the Council advise the Western Australian Planning Commission that -

1. In accordance with Regulation 66(3)(a) of Division 1, Part 6 of the *Planning and Development (Local Planning Schemes) Regulations 2015*, it recommends that Local Planning Scheme 21 'should be amended' in a manner as generally described in the 'Officer Comment' section of the agenda report and the accompanying Attachment A.

2. Should the recommended approach outlined in point 1 above not be agreed by the Commission, the next recommended preference of the Council would be to undertake a 'total amendment' of Local Planning Scheme 21, in a manner as generally described in the 'Officer Comment' section of the agenda report.

3. The current report is accepted by the Council as constituting, in its entirety, the required 'Report of Review' in respect to Local Planning Scheme 21 and, as such, is to be forwarded to the Commission, in minuted form, with the request that the Commission agree to the position represented in this resolution.

11. PLANNING AND DEVELOPMENT SERVICES REPORT

11.1 DEVELOPMENT CONTROL FRAMEWORK - REVIEW AND PROPOSED DIRECTION

SUBJECT INDEX:	Development Control Policy
STRATEGIC OBJECTIVE:	Governance systems that deliver responsible, ethical and accountable decision-making.
BUSINESS UNIT:	Planning and Development Services
ACTIVITY UNIT:	Statutory Planning / Strategic Planning
REPORTING OFFICER:	Director, Planning and Development Services - Paul Needham
AUTHORISING OFFICER:	Director, Planning and Development Services - Paul Needham
VOTING REQUIREMENT:	Simple Majority
ATTACHMENTS:	Nil

PRÉCIS

This report sets out the proposed direction for the modification and updating of the City's development control framework, following an internal review of the framework. A series of amendments to the town planning scheme are proposed, together with the review and/or development of local planning policies, structure plans and activity centre plans, and the development of two new local laws.

BACKGROUND

The Council is asked to consider recommendations that have resulted from a review of the City's overall development control framework (i.e. including both the planning framework and some broader elements, including controls on portable signage). The report and recommendations set out the proposed overall direction to modify and update that framework. The main reasons for undertaking the review are as follows –

1. With the Council now having made a final decision regarding the City's *Local Planning Strategy* (although the WAPC is yet to do so), the City now nearly has a full suite of high-level, planning strategies (i.e. *Local Planning Strategy*, *Local Rural Planning Strategy*, *Local Tourism Planning Strategy*, *Local Commercial Planning Strategy, Local Environmental Planning Strategy* and *Local Cultural Planning Strategy*), and there is a need to reflect the recommendations of those strategies in the subsidiary elements of the development control framework (i.e. the *City of Busselton Local Planning Scheme 21* – 'Scheme', structure plans or similar and/or local planning policies);
2. With the Gazettal of the *Planning and Development (Local Planning Schemes) Regulations 2015* ('the Regulations'), elements of the Scheme are now redundant or outdated, as they have been superseded by provisions in Schedule 2 of the Regulations ('the Deemed Provisions'), and/or are inconsistent with provisions in Schedule 1 of the Regulations ('the Model Provisions');
3. There has been substantial development and review of the development control framework at the State and regional level in recent years, and elements of the City's framework are now inconsistent with that higher level direction;
4. There have been changes made in the actual practical implementation of development controls in recent years, and in the interests of clarity, simplicity and robustness of decision-making, it is seen as important that policy and practice are more closely aligned;
5. The experience of actually implementing the current framework has identified a range of efficiencies and improvements that could be gained;

6. The physical, social and/or economic context and character of the City has and will continue to evolve, including through quite substantial change in some areas, and elements of the planning framework may no longer be appropriate given those changes;
7. Elements of the planning framework have been developed in a somewhat *ad hoc*, responsive fashion over a long period of time, resulting in what is now seen as being unnecessary complexity and inconsistency, and in some cases uncertainty and ambiguity; and
8. Regulation 65 of the Regulations requires a review of the Scheme in the fifth year after it was Gazetted which, given that the Scheme was Gazetted in 2014, means a review needs to be undertaken in 2019, and it is therefore timely to start preparing for that review.

What is proposed involves, in part, several omnibus amendments to the Scheme (remembering there has already been one omnibus amendment to the current scheme, which was Amendment 1 – and which, at the time of writing, is awaiting a final decision by the Minister for Planning), as follows –

1. *Omnibus Amendment 2* (Amendment 25) - An amendment to align the scheme with the Deemed Provisions.
2. *Omnibus Amendment 3* (Amendment 28) - An amendment to align the various 'development zone provisions' in the Scheme with each other, and with both the Deemed Provisions and the Model Provisions, as well as to consolidate the zonings applicable to land in the various, existing 'development zones' where that land has now been developed.
3. *Omnibus Amendment 4* (Amendment 29) - An amendment to align the other zones with the standard suite of zones set out in the Model Provisions, to more broadly align the Scheme with the Model Provisions, to review and refine the 'policies and objectives' and other provisions of each of the zones, to more closely align with the Model Provisions, to review and align land-use definitions to be more consistent with the Model Provisions, and to review of the zoning table to avoid unintended consequences.
4. *Omnibus Amendment 5* (Amendment 30) - An amendment to further implement recommendations of the adopted planning strategies, and to also align the Scheme with State Planning Policies ('SPPs').
5. *Omnibus Amendment 6* (Amendment 31) - An amendment to make a number of substantive changes identified as desirable through review of the current approach and policies in relation to a range of detailed development matters.
6. *Omnibus Amendment 7* (Amendment 32) - A further amendment to address a range of detailed mapping issues, as well as further consolidation of Schedule 2 ('Additional Uses') and Schedule 3 ('Special Provision Areas') of the Scheme, together with some related consolidation/review of Part 5 of the Scheme ('General Development Requirements').
7. *Omnibus Amendment 8* (Amendment 33) – A review of residential density and 'Special Character Areas' controls.

The recommendations also identify, as priorities, development of the following new or revised structure and/or activity centre plans –

1. Dunsborough Structure Plan;
2. Dunsborough Activity Centre Plan; and
3. Busselton Activity Centre Plan.

What is proposed also involves revoking, adopting and/or modifying local planning policy and/or Council policy, broadly as follows –

1. Rationalisation/review of redundant/outdated structure plans or similar;

2. Adoption of new local planning policies relating to signage/advertising controls, fencing controls, and non-agricultural development in rural areas, the latter intended to expand on and replace the existing rural tourism accommodation policy;
3. Adoption of a new Council policy relating to portable signage (e.g. 'A-frame' or 'sandwich board' signs) on thoroughfares, guiding the exercise of powers set out in the *City of Busselton Activities in Thoroughfares and Public Places and Trading Local Law 2015* ('Thoroughfares Local Law');
4. Adoption of a new Council policy relating to planning/development compliance;
5. Consolidating and reviewing existing local planning policies relating to residential development and outbuildings, development in Special Character Areas and extractive industry; and
6. Consolidating and reviewing existing policy direction relating to heritage which is, in part local planning policy and in part Council policy (and also completing the review of the City's Heritage List and Municipal Heritage Inventory).

In addition, the development and adoption of two new local laws, a fencing local law and an extractive industry local law, is also proposed.

It should also be noted that the City's *Draft Local Planning Strategy* identifies a number of further initiatives for future development and review of the planning framework. Those not identified in this report, however, are not considered to be priorities at the present time and/or for the next 2-3 years (which is broadly the timeframe envisaged for the work set out in this report – although some of the work outlined here would extend a little beyond that time).

STATUTORY ENVIRONMENT

Relevant statutory environment is set out in the following legislation –

- *Planning and Development 2005*
- *Planning and Development (Local Planning Schemes Regulations) 2015*
- *City of Busselton Local Planning Scheme 21*
- *Building Act 2012*
- *Building Regulations 2012*
- *Local Government 1995*
- *Dividing Fences Act 1961*
- *Dividing Fences Regulations 1971*
- *City of Busselton Property Local Law*
- *City of Busselton Activities on Thoroughfares and Public Places and Trading Local Law*

The legislation listed above has been considered in developing the recommendations of this report.

Particular note is made of Part 6 of the *Planning and Development (Local Planning Schemes Regulations) 2015.* Regulation 65 in Part 6 sets out that a local government must carry out of a review of local planning scheme in the fifth after the scheme was Gazetted, or the fifth year since the previous review was completed. Regulation 65(3) sets out the local government, in undertaking the review, must prepare and submit to the Western Australian Planning Commission ('WAPC'), for their consideration and decision, a report which makes recommendations as to whether the scheme –

- Is satisfactory in its current form; or

- Should be amended; or
- Should be repealed and a new scheme put in its place.

As set out in the 'Officer Comment' section of this report, one of the aims of the proposed work set out in this report is to ensure that, when that report is presented to and considered by the WAPC, the preparation of a new scheme is not considered necessary.

The Regulations also establish three different categories of amendments, which can be briefly described as follows –

- 'Basic' – An amendment to align a scheme with another, existing planning document (such as with the Deemed Provisions or Model Provisions, or with a structure plan), and which can be undertaken without the need for consultation;
- 'Standard' – An amendment that rezones land in a manner generally consistent with the current strategic direction, and which requires consultation, but consultation can occur without prior approval of the WAPC; and
- 'Complex' – An amendment of very significant impact, or which may not be consistent with existing strategic direction, or an amendment that the Minister for Planning has directed the local government to commence, and which requires consultation, but only with the prior approval of the WAPC.

RELEVANT PLANS AND POLICIES

The following plans and policies are relevant to and have been considered in developing the recommendations of this report –

- *Draft City of Busselton Local Planning Strategy*
- *City of Busselton Local Commercial Planning Strategy*
- *City of Busselton Local Rural Planning Strategy*
- *City of Busselton Local Environmental Planning Strategy*
- *City of Busselton Local Tourism Planning Strategy*
- *City of Busselton Local Cultural Planning Strategy*
- *Busselton City Centre Conceptual Plan*
- *Dunsborough Town Centre Conceptual Plan*
- *City of Busselton Local Planning Policy Manual*
- *WAPC South West Planning and Infrastructure Framework*
- *State Planning Policies*

FINANCIAL IMPLICATIONS

Implementation of the recommendations of this report will require the allocation of significant officer time, which will largely be achieved through the allocation and use of existing staff resources. Some of the recommendations of this report will, however, require the engagement of external consultants or other expertise, which will need to be allocated in the City's budget in future financial years. More detailed proposals will be presented to the Council for consideration as part of forthcoming and future budget development processes. In addition, City officers will seek to identify and secure external funding where the opportunity arises. In particular, it is considered that Regional Centres Development Programme funding may be available to assist with development of activity centre plans for the Busselton City Centre and the Dunsborough Town Centre.

A number of the recommendations will result in a planning framework that is simpler, clearer and more easily understood and, as such, should result in greater efficiency of implementation and lower costs to the City and its ratepayers over time. There should also be a reduction in compliance costs and regulatory uncertainty from the private sector/community perspective.

Long-term Financial Plan Implications

Other than those outlined briefly above, there are no Long-term Financial Plan implications of the recommendations of this report.

STRATEGIC COMMUNITY OBJECTIVES

The recommendations of this report reflect Strategic Objective 6.2 of the *Strategic Community Plan.*

RISK ASSESSMENT

Because of the scope and breadth of the recommendations of this report, it is not practicable to provide an overall risk assessment of all of the recommendations. All of the recommendations of this report will, however, require further, formal Council consideration and reporting, and more focused risk assessment will be provided when those reports are presented to the Council. A fundamental reason for doing the work set out in this report, though, is to reduce the risks to the City and our community that may arise from not having an up to date, appropriate and sufficiently clear planning framework.

CONSULTATION

There has been no broad consultation specifically undertaken as part of the development of this report. The recommendations of the report, though, reflect the outcomes of other consultation exercises undertaken in the past, including through the development of planning strategies, and associated with the development and review of the *Strategic Community Plan.* Implementation of the recommendations will also require consultation, and the outcomes of such consultation will need to be reported to and considered by the Council prior to the Council being asked to make any final decisions.

In addition, informal, officer level feedback has been sought from the Department of Planning on the proposed approach and priorities, and the feedback received considered in the preparation of this report.

OFFICER COMMENT

The recommendations of this report are outlined and discussed below, under the following sub-headings –

1. Omnibus Amendment 2 (Amendment 25) – Deemed Provisions Alignment;
2. Omnibus Amendment 3 (Amendment 28) – Development Zones Consolidation;
3. Omnibus Amendment 4 (Amendment 29) – Model Provisions Alignment;
4. Omnibus Amendment 5 (Amendment 30) – Implementation of Adopted Planning Strategy and State Planning Policy Recommendations;
5. Omnibus Amendment 6 (Amendment 31) – Miscellaneous Development Control Changes;
6. Omnibus Amendment 7 (Amendment 32) – Mapping and Schedules Consolidation / Review/rationalization of redundant/outdated structure plans or similar;

7. Omnibus Amendment 8 (Amendment 33) – Residential Density and Special Character Area Controls Review / review of Special Character Area Policies;
8. Dunsborough Structure Plan;
9. Activity Centre Plans;
10. Signage/advertising regulation;
11. Fencing regulation;
12. Extractive industry regulation;
13. Non-agricultural development in rural areas;
14. Heritage;
15. Planning/development compliance; and
16. Scheme review.

Omnibus Amendment 2 (Amendment 25) – Deemed Provisions Alignment

This proposal is relatively easily described, and would involve an amendment to align the scheme with the Deemed Provisions, deleting provisions in the Scheme that are wholly superseded, and inserting notes directing users to the relevant parts of the Deemed Provisions, as well as inserting additional notes where provisions in the Scheme have been partly superseded by the Deemed Provisions. The key benefit of the amendment would be to reduce potential confusion or uncertainty related to having to read the Scheme and Deemed Provisions together.

This amendment would be a basic amendment.

Omnibus Amendment 3 (Amendment 28) – Development Zones Consolidation

This proposal would involve an amendment to align the various 'development zone provisions' in the Scheme with both the Deemed Provisions and the Model Provisions, as well as to introduce consolidated development zone provisions into the Scheme (this would include, amongst other things, the introduction of two new zones, 'Urban Development' and 'Industrial Development'). This amendment would also consolidate the zonings applicable to land in the various, existing 'development zones' where that land has now been developed, and can now have a substantive zoning directly applied (e.g. in the case of residential land, rezoning the land to 'Residential', and applying a residential density coding, e.g. 'R20'). As part of this amendment, consideration would also be given to rezoning two urban growth areas currently identified in the LPS, but not currently in a suitable development zone – i.e. Bovell and Vasse East.

Whilst it could arguably be characterized as a basic amendment, this amendment would be treated as a standard amendment to ensure that affected landowners in particular would be consulted with.

Note that, because a broad review of the Port Geographe Development Guide Plan (now more correctly referred to as the 'Structure Plan') is expected to occur in the nearer term and because land in the Port Geographe Development Area is already subject of directly applied substantive zonings, that area would not be addressed through this Amendment. In parallel with the broad review of the Structure Plan expected to formally commence in the next few months, however, it is envisaged that a separate amendment would be undertaken to rationalize and consolidate the planning framework applicable to that area, aligning with the approach proposed in relation to the other 'development zones'.

Omnibus Amendment 4 (Amendment 29) – Model Provisions Alignment

This amendment would involve aligning the other zones with the standard suite of zones set out in the Model Provisions. For instance, the 'Agriculture' zone would become the 'Rural' zone, and the 'Business' zone would become the 'Centre' zone – consideration would also be given to establishing different zones for some of the centres, for instance a 'City Centre' zone for the Busselton City Centre.

This amendment would also review and refine the 'policies and objectives' and other provisions of each of the zones, to more closely align with the Model Provisions. To be consistent with the Model Provisions, the 'policies and objectives' would be rationalised to identify 'objectives' only, however, some of the 'policies' may need to instead be reflected in development standards, in Part 5 of the Scheme, and reflected in Omnibus Amendments 6, 7 and/or 8. This would also involve reviewing and aligning land-use definitions to be more consistent with the Model Provisions, and to address/resolve some uncertainties/inconsistencies that have emerged over time. Note that this would also necessarily entail a review of the zoning table to avoid unintended consequences. Given recent experiences in relation to some unintended consequences arising from interpretation of land use definitions by the State Administrative Tribunal, consideration would also be given to correcting those kinds of issues.

For consistency with the Model Provisions and reflecting the smaller size of some 'Rural-Residential' zoned lots (some as low as 1,800m^2, rather than the 1.0 ha or greater normally contemplated by that zoning), and especially the fact that the lot sizes overlap with those provided for in the *Residential Design Codes of WA* ('R-Codes', i.e. up to an average of 5,000m^2, where land is subject of the 'R2' residential density coding), consideration would be given to rezoning Rural-Residential zoned lots up to around 6,000m^2 to 'Residential', and applying an appropriate residential density coding (generally 'R2', 'R2.5' or 'R5'). This would mainly, probably exclusively, affect the Vasse-Dunbarton area, not the Commonage. Consideration would also need to be given to the need to continue to provide a head-of-power for existing structure plan controls, where they remain valid and relevant.

There are also some further, relatively minor changes envisaged to more broadly align the Scheme with the Model Provisions. In the main, though, they relate to provisions where the Scheme is already very closely aligned with the Model Provisions.

This amendment would be a standard amendment.

Omnibus Amendment 5 (Amendment 30) – Implementation of Adopted Planning Strategy and State Planning Policy Recommendations

This amendment would involve further implementing the recommendations of the adopted planning strategies, including the recommendations/direction that will be set out in the Leeuwin-Naturaliste Sub-Regional Planning Strategy ('LNSRS'), once that strategy has been developed, and to also align the Scheme with State Planning Policies ('SPPs'). This is one of the most important amendments in terms of the forthcoming scheme review process, as consistency with State strategies and SPPs will be key issues in determining whether or not a new scheme is necessary. Until such time as the LPS and LNSRS is complete, however, it is not possible to scope out this amendment in detail.

This amendment would most likely be a standard amendment.

Omnibus Amendment 6 (Amendment 31) – Miscellaneous Development Control Changes

This amendment would involve a number of substantive changes identified as desirable through review of the current approach and policies in relation to a range of detailed development matters (specifically: residential development, including outbuildings; signage/advertising controls; fencing controls; public open space provision where subdivision is not involved; and development in activity

centres). This amendment would be focused on Parts 5 ('General Development Requirements') and 6 ('Special Control Areas').

This amendment would not, however, provide for a review of the 'Airport Protection Area', which it is anticipated will be reviewed via a separate, stand-alone amendment, which would also rationalize the land-use controls applicable to the Airport site itself. Nor would this amendment provide for a review of the 'Waste Water Exclusion Area and Waste Water Buffer Area', which would need to be subject of a stand-alone amendment, at the initiative of Water Corporation (i.e. the operators of the two waste water treatment plants in the District).

Depending on progress on the development of the City's 'Coastal Adaptation Strategy' at the time this amendment is ready to be presented to the Council for initiation, this amendment may provide for change/review of the 'Coastal Management Area'. If substantial change is required and/or the Adaptation Strategy is not sufficiently advanced, though, that would instead also be subject of a stand-alone amendment.

This amendment would be a standard amendment.

Omnibus Amendment 7 (Amendment 32) – Mapping and Schedules Consolidation / Review/rationalization of redundant/outdated structure plans or similar

This amendment would address a range of detailed mapping issues, as well as further consolidation of Schedule 2 ('Additional Uses') and Schedule 3 ('Special Provision Areas') of the Scheme, together with some related consolidation/review of Part 5 of the Scheme ('General Development Requirements'). A significant amount of the content of Schedules 2 and 3 is redundant or outdated and/or could be significantly rationalized. The same is true with respect to a significant proportion of the over 400 structure plans or similar which have been developed over the last few decades but, in the main, never reviewed.

This amendment would be a standard amendment.

Omnibus Amendment 8 (Amendment 33 – Residential Density and Special Character Area Controls Review / review of Special Character Area Policies

A review of residential density and 'Special Character Areas' controls, including the variations to the R-Codes set out in clause 5.3 of the Scheme. It is envisaged that the subsidiary, Special Character Area Policies, would be reviewed in parallel with this amendment.

This amendment would most likely be a standard amendment.

Dunsborough Structure Plan

Within the next 5-6 years, it is expected that the 'Dunsborough Lakes' estate will be fully developed – or at least all of the new lots will have been created, although houses will not have been developed on all of the new lots. Whilst there is some capacity for additional residential land supply to be created out of other, currently zoned land (such as in the 'Cape Rise' and 'Naturaliste Heights' estates), it has been recognized by both the City and WAPC that the further growth and development of Dunsborough will require the identification and planning of an additional growth area, extending generally in a south-south-easterly direction across Commonage Road from the current and planned portions of Dunsborough Lakes.

The pattern of land ownership in this area (i.e. quite fragmented, and generally not in the hands of experienced and motivated 'developers') is such that, especially to achieve an integrated and well planned development outcome, the City will need to lead the initial development of a structure plan to facilitate development of this area. It is envisaged that, as a result of the City's *Local Planning*

Strategy and/or the LNSRS, appropriate strategic support will be provided to allow that work to commence. Key issues to be addressed would include –

- An integrated transport network (road, pedestrian, cycle and public transport), in particular, the potential for a 'Dunsborough Southern Distributor', linking the future Vasse-Dunsborough Link with Commonage Road and, via Biddle Road, with Caves Road, to the west of Dunsborough to, amongst other things, divert some regional and heavy traffic away from Caves Road, which now runs through the middle of the Dunsborough urban area and adjacent to the Dunsborough Town Centre;
- Identifying sites for significant public infrastructure, including schools and community and recreational facilities;
- Identifying key environmental constraints, ecological corridors and addressing bushfire risk at the strategic level;
- Identifying a site and general direction for development of an activity centre to provide local services to the new growth area;
- Providing a mechanism for the equitable and efficient funding and sharing of costs associated with infrastructure and open space provision (i.e. in part, developer contributions arrangements); and
- Integrating and assessing the impacts of the new growth area on the planning and development of the existing Dunsborough urban area, growth and development in the north-western part of the City more broadly and, in particular, considering the future growth and development of the Dunsborough Town Centre.

Activity Centre Plans

This would involve the development of 'Activity Centre Plans', which are a form of structure plan provided for in the Regulations, for both the Busselton City Centre and Dunsborough Town Centre. The WAPC has already approved the development of such plans, and it is anticipated that the work will, at least in part, be funded from the Regional Centres Development Programme ('RCDP' - subject to approval by the Growth Plan Partners and the relevant State agencies/authorities). Activity Centre Plans are 'planning' documents, but do not focus entirely on 'planning' content; they are intended to be broader documents, also dealing with 'place-making' and 'activation' type strategies. The Activity Centre Plans would build on the work undertaken to develop the 'Conceptual Plans' for the two centres, as well as other related work.

Signage/advertising regulation

This work would relate to both fixed signage on private land (controlled via the Scheme and the Building Act) and portable signage on public land (controlled via the thoroughfares local law), but not to directional or informational signage.

The statutory powers related to portable signage that are now in place are considered sound, and so the work related to portable signage would involve development and then implementation of a Council policy guiding the implementation of those powers. It is envisaged that a report to that end will be presented to the Policy & Legislation Committee in the next month or so.

The statutory powers related to fixed signage on private land are also considered to be generally sound, and so the work related to this kind of signage would be focused on development of a new local planning policy. More detailed work, though, may identify a need for some changes to the Scheme, which it is envisaged would be reflected in Omnibus Amendment 6. Again, it is envisaged that a report will be presented to the Policy & Legislation Committee in coming months.

Fencing regulation

The regulation of fencing in WA is principally controlled via the dividing fences legislation, which sets out the rights and duties of landowners in relation to fencing of their properties. State level regulation is often, although not currently in the case of the City, supplemented by fencing local laws, adopted at the local government level. The main purpose of a fencing local law is to establish what a 'sufficient fence' is for the purposes of the dividing fences legislation, which otherwise would be determined by the courts, through reference to the fencing typically in place in a given area. In the last few decades, however, there has also been increasing use of planning controls to regulate front fences, including through the R-Codes and through structure plan provisions, the latter especially relevant in rural-residential areas where, in some cases, boundary fencing is not supported at all.

Whilst the development of a fence clearly meets the definition of 'development' in the planning legislation, and there are no exemptions from the need to obtain planning approval, other than in the case of R-Codes compliant front fencing in residential areas, the regulatory arrangements for approval of fencing in the City, both in practice and in law, are not entirely clear. There are also some matters on which regulation may well be desirable, but which are currently not specifically regulated (for instance, use of electric fencing or razorwire or similar, and use of highly flammable fencing materials in bushfire prone areas).

It is envisaged that the City develop a fencing local law to identify what types of fences should be deemed as 'sufficient fences' in given areas, and to then develop, in parallel, consistent Scheme and local planning policy provisions. There is a model local law and a number of other local laws, adopted by other local governments, which would be used as a base from which to develop the City's own local law. Depending on the rate at which the different projects advances and the extent of change required, the relevant Scheme changes may be incorporated into Omnibus Amendment 6. Other than the matters outlined very briefly above, one of the aims would be to develop a consistent and coherent approach to regulation of boundary fencing in rural-residential areas, and to address residential character and amenity concerns resulting from side fences within residential front setbacks.

Extractive industry regulation

Access to basic raw materials (i.e. sand, gravel, limestone or similar basic 'raw materials', but not 'minerals' or 'petroleum', land-based extraction of which is generally a State matter) is important from many respects, notably from an economic perspective, and such materials are becoming increasingly scarce and valuable. For that reason, continued access to such resources is important. For that to continue, however, it is important that the City's regulation of extraction activity continues to be robust and credible, and that the industry is regulated and acts in a fashion that ensures its 'social license' to operate.

The City currently regulates extractive industry through the Scheme, guided by a local planning policy. The local planning policy is due for review, and there are three key issues already identified as requiring consideration as part of that review –

- Requiring periodic (annual) performance reporting, in particular in terms of volumes extracted and progress with rehabilitation as conditions of approval – note that this has already been adopted as a practice;
- Considering alternatives to arbitrary separation distances (or setbacks) from extractive industry to sensitive land uses – this may include facilitating or requiring 'amenity agreements' or similar, which are commonplace in relation to mining activity; and
- Considering the introduction of volumetric charges for road maintenance/use, the validity of which has recently been upheld by the Supreme Court.

The first dot point above is, in part, intended to address issues that can arise where the landowner and pit operator are not the same entity, and/or the landowner, who is ultimately responsible for the pit, is not adequately resourced or skilled to ensure that conditions of approval are met on an ongoing basis. It is envisaged that the annual performance reporting would pick up such issues, before they become too significant.

Many local governments, however, have extractive industry local laws, which require and provide for the registration of pit operators, allowing the operators to become directly responsible for pit management and rehabilitation. Whilst a landowner can also be the operator, extractive industry local laws generally act to effectively discourage that from occurring, other than in situations where the landowner is genuinely the pit operator, and sufficiently resourced and skilled to meet all of the obligations that entails. In the absence of a local law and registration requirements, it is generally the landowner that will be legally responsible for ensuring the pit is adequately managed, and that conditions are met.

Non-agricultural development in rural areas

The City currently has a policy on 'Rural Tourist Accommodation' (i.e. Local Planning Policy 5B). The policy has not been substantively reviewed in over a decade. In the intervening period, and generally over the last few decades, there has been a substantial increase in both the scale and the breadth of not just tourist accommodation development in rural areas, but in a range of other non-agricultural land-uses as well. That includes the recent emergence of 'glamping' proposals, as well as the expansion of winery cellar door facilities to provide for a broader range of, essentially retail, activity, together with development of, often very significant, restaurant and function facilities. Breweries and distilleries and related restaurant/bar facilities have also been developed, together with other food production and/or retailing facilities, often, but not always, related to agricultural activity in the locality or region.

It is considered reasonably likely that these trends will continue, and that there may also be pressure and opportunities in future for educational and/or health related facilities to develop in our rural areas, taking advantage of the amenity and experience provided by the rural landscape, as well as the relatively low land values, in comparison with equivalent sites in urban areas. These kinds of development are all seen as being important contributors to the local economy and to local employment.

In terms of their physical 'footprint', these land-uses often do not occupy much land, in the context of our rural areas, and many agricultural activities can and do continue alongside these other kinds of uses – and in many cases, there are synergies between agricultural and non-agricultural uses (e.g. viticulture, wineries and restaurants). There is nevertheless the potential for this kind of development to compromise both current and future agricultural activity, both because of potential land-use conflict (e.g. by putting sensitive uses within recommended buffer areas for agricultural activities), but also by increasing the value of rural land (making agricultural activity less economically viable) and/or by reducing the availability of water for agricultural use. In addition, there is the potential for non-agricultural uses of rural land to change the character of rural areas, undermining the amenity and experience provided by the rural landscape in the process.

The City and Shire of Augusta-Margaret River, through CapeROC, undertook a project several years ago to review and attempt to rationalize, land-use and development controls in the rural areas of each District – and the recommendations of that project have now been reflected in the respective town planning schemes. The issue of non-agricultural development is also being considered as part of the development of the LNSRS, although it is likely that detailed guidance will not be provided at that level of the planning framework. Given that and the broader issues, however, some consideration should be given to the potential for development of more detailed policy guidance at the sub-regional level.

One consequence of this work may be the identification of changes that should be made to the Scheme, but it is considered that the main output would be a local planning policy.

Heritage

A review of the Heritage List and Municipal Heritage Inventory has been undertaken over the last few years, and is largely, but not entirely complete. When resources allow, it is envisaged that work will recommence, and that a further review of the broader policy framework in relation to heritage protection will also occur.

Planning/development compliance

There has been an increased focus on planning and development compliance in recent years, partly as a result of a perceived increase in community interest and expectation. Partly as a result of that, there is seen to be a need to develop a policy on planning/development compliance matters, setting out the approach that the City will take with respect to those matters.

Scheme review

In late 2018, it is anticipated that the City would commence the Scheme review process. That would involve the scoping of the relevant issues in consultation with the Department of Planning, and in liaison with the Council. It would be expected that a Scheme review report would then be presented for the Council's formal consideration during 2019.

One of the aims of the proposed work described in this report is so that, when the Scheme review is undertaken, the Scheme is essentially already up to date, or there is a clear path to having an up to date scheme already being pursued, so that the preparation of a new scheme is not required. Preparation of a new scheme would require a moratorium on town planning scheme amendments for a period – essentially because any amendment not complete prior to the new scheme coming into effect would effectively 'fall away' at that point, and the amendment process would have to be recommenced, from the start, as an amendment to the then new scheme.

A moratorium would result in a temporary acceleration in the number of amendments being progressed (in the lead-up to the moratorium, as people seek to have amendments progress prior to the moratorium taking effect), which could have significant workload implications for the City's Strategic Planning team. More importantly, a moratorium would preclude any new, landowner/developer initiated amendments being initiated during the moratorium period, potentially delaying planning and investment decisions unnecessarily.

CONCLUSION

The direction set out in this report is the result of a broad review of the City's overall development control framework, and identifies a direction that identifies appropriate priorities, and should result in an up to date, relevant and functional planning framework into the future.

OPTIONS

The Council could decide to identify different priorities for the review and development of the planning framework.

TIMELINE FOR IMPLEMENTATION OF OFFICER RECOMMENDATION

It is anticipated that the work identified in this report will take 3-4 years to complete. A number of more detailed and specific reports will need to be presented to the Council to that end over that period.

Council Decision/Committee Recommendation and Officer Recommendation

C1704/088 Moved Councillor J McCallum, seconded Councillor G Bleechmore

That the Council endorse the direction and priorities for the development and review of the City's development control framework as described in the agenda report, summarized as follows –

1. Omnibus Amendment 2 (Amendment 25) – Deemed Provisions Alignment;
2. Omnibus Amendment 3 (Amendment 28) – Development Zones Consolidation;
3. Omnibus Amendment 4 (Amendment 29) – Model Provisions Alignment;
4. Omnibus Amendment 5 (Amendment 30) – Implementation of Adopted Planning Strategy and State Planning Policy Recommendations;
5. Omnibus Amendment 6 (Amendment 31) – Miscellaneous Development Control Changes;
6. Omnibus Amendment 7 (Amendment 32) – Mapping and Schedules Consolidation / Review/rationalization of redundant/outdated structure plans or similar;
7. Omnibus Amendment 8 (Amendment 33) – Residential Density and Special Character Area Controls Review / review of Special Character Area Policies;
8. Dunsborough Structure Plan;
9. Activity Centre Plans;
10. Signage/advertising regulation;
11. Fencing regulation;
12. Extractive industry regulation;
13. Non-agricultural development in rural areas;
14. Heritage;
15. Planning/development compliance; and
16. Scheme review.

CARRIED 9/0

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14. ENGINEERING AND WORK SERVICES REPORT

Nil

15. COMMUNITY AND COMMERCIAL SERVICES REPORT

Nil

16. FINANCE AND CORPORATE SERVICES REPORT

Nil

17. CHIEF EXECUTIVE OFFICERS REPORT

17.1 COUNCILLORS' INFORMATION BULLETIN

SUBJECT INDEX:	Councillors' Information Bulletin
STRATEGIC OBJECTIVE:	Governance systems, process and practices are responsible, ethical and transparent.
BUSINESS UNIT:	Governance Services
ACTIVITY UNIT:	Governance Services
REPORTING OFFICER:	Executive Assistant to Council - Katie Banks
AUTHORISING OFFICER:	A/Chief Executive Officer – Naomi Searle
VOTING REQUIREMENT:	Simple Majority
ATTACHMENTS:	Nil

PRÉCIS

This report provides an overview of a range of information that is considered appropriate to be formally presented to the Council for its receipt and noting. The information is provided in order to ensure that each Councillor, and the Council, is being kept fully informed, while also acknowledging that these are matters that will also be of interest to the community.

Any matter that is raised in this report as a result of incoming correspondence is to be dealt with as normal business correspondence, but is presented in this bulletin for the information of the Council and the community.

INFORMATION BULLETIN

17.1.1 2018/2019 TENDERS

PQS01/19 PLANT AND EQUIPMENT HIRE – REQUEST FOR APPLICATIONS TO JOIN A PANEL OF PRE-QUALIFIED SUPPLIERS

- Requirement – hire of plant and equipment.
- The PQS was advertised on 9 February 2019 with a closing date of 7 March 2019.
- The closing date has been extended until 14 March 2019. A further State wide advertisement providing notification of the extension was provided by the City on 9 March 2019.
- Thirty submissions were received.
- In accordance with delegation LG3M the CEO has authority to establish the panel and to decide which applications to accept.
- It is anticipated that the panel of pre-qualified suppliers will be established by the CEO in May 2019.

PQS02/19 SUPPLY OF CONCRETE SERVICES – REQUEST FOR APPLICATIONS TO JOIN A PANEL OF PRE-QUALIFIED SUPPLIERS

- Requirement – supply of concrete services.
- The PQS was advertised on 9 March 2019 with a closing date of 2 April 2019.
- Seven submissions were received.
- In accordance with delegation LG3M the CEO has authority to establish the panel and to decide which applications to accept.
- A panel of 3 pre-qualified suppliers was established by the CEO in April 2019, which included (in order of ranking) Leschenault Excavations Pty Ltd, Axiis Contracting Pty Ltd and The Trustee of the Adam J Soulas Family Trust T/A Dunsborough Concrete Contracting.

RFT01/19 SUPPLY OF MOBILE WASTE SHREDDER

- Requirement – the supply of a mobile waste shredder to be delivered at the Dunsborough Waste Facility.
- A Request for Tender was advertised on 9 March 2019 with a closing date of 26 March 2019.
- Five submissions were received.
- The value of the contract is expected to exceed the CEO's delegated authority under Delegation LG3J and will require Council approval.
- It is anticipated that the contract will be awarded in May 2019.

RFT02/19 PROVISION OF CLEANING SERVICES TO CITY OWNED FACILITIES

- Requirement – the provision of cleaning services to City owned facilities.
- A Request for Tender was advertised on 9 March 2019 with a closing date of 4 April 2019.
- Eight submissions were received.
- The value of the contract is expected to exceed the CEO's delegated authority under Delegation LG3J and will require Council approval.
- It is anticipated that the contract will be awarded in May 2019.

RFT03/19 ROCK COASTAL PROTECTION REFURBISHMENT: CRAIG STREET AND WONNERUP

- Requirement – refurbishment of six rock coastal protection structures on Geographe Bay, including a groyne and seawall at Craig Street and four groynes at Wonnerup.
- A Request for Tender was advertised on 16 March 2019 with a closing date of 2 April 2019.
- Seven submissions were received.
- The value of the contract is not expected to exceed the CEO's delegated authority under Delegation LG3J.
- A contract was awarded by the CEO in April 2019 to Leeuwin Civil Pty Ltd.

RFT04/19 SUPPLY OF TWO TRI-AXLE SIDE TIPPING TRAILERS

- Requirement – supply of two tri-axle side-tipping trailers.
- A Request for Tender was advertised on 23 March 2019 with a closing date of 9 April 2019.
- Four submissions were received.
- The value of the contract is not expected to exceed the CEO's delegated authority under Delegation LG3J.
- It is anticipated that the contract will be awarded in May 2019.

RFT05/19 CITY CENTRE EASTERN LINK

- Requirement – following an Expression of Interest (EOI 01-18) process for making a preliminary selection among prospective tenderers, the City of Busselton invited tenders for the construction of the City Centre Eastern Link Road upgrade including stages 1,2A and 2B.
- Three tenderers were invited to submit a tender – Georgiou Group Pty Ltd, Ertech Pty Ltd and BMD Constructions Pty Ltd, with a closing date of 14 May 2019.
- The closing date has been extended to 28 May 2019.
- The value of the contract is expected to exceed the CEO's delegated authority under Delegation LG3J and will require Council approval.
- It is anticipated that the contract will be awarded in July 2019. However contract commencement is subject to the relevant conditions precedent being satisfied including environmental approvals being obtained.

17.1.2 Donations Contributions and Subsidies Fund – April 2019

The Council allocates an annual budget allowance to the Donations, Contributions and Subsidies (Sponsorship Fund). This is provided such that eligible groups and individuals can apply for and receive sponsorship to assist them in the pursuit of endeavours that bring direct benefit to the broader community. Allocation of the funds is delegated to the Chief Executive Officer, in accordance with published guidelines and funding availability.

Four applications were supported in April 2019, totalling $2000.00 as outlined in the table below:

App. No.	Recipient	Purpose	Amount
April 2019			
56/1819	Maddison Fenwick	Seeking funds to assist with travel to attend the U15 Championships Hockey tournament in NSW. Maddison has been chosen to represent WA.	$300.00
57/1819	Relay for Life Busselton Committee	Seeking in kind support to cover the cost of holding the event at Churchill Park i.e. hall, ground and bin hire and event application fee. Funds are raised for Cancer Council WA who provide support to local residents through their office on Prince Street in Busselton.	$1,000.00
58/1819	GeoCatch	Funds to assist with the printing of "Pets Away Possums Play" bin stickers to assist in raising awareness of their campaign.	$500.00
62/1819	Arts Margaret River	The Young Writers and Readers Program tours primary and secondary schools as part of the Margaret River readers and Writers Festival. Funds were requested to assist with covering the cost of author fees to attend schools and promote the joy of reading from an early age. Busselton Primary School and Georgiana Molloy Anglican School have confirmed their participation in the program.	$200.00
		April Total	**$2,000.00**

At the end of April 2019, expenditure from the Donations, Contributions and Subsidies Fund totalled $20,471.00, leaving a balance of $9,529.00.

OFFICER RECOMMENDATION

That the items from the Councillors' Information Bulletin be noted:

- 17.1.1 2018/2019 TENDERS
- 17.1.2 Donations Contributions and Subsidies Fund – April 2019

18. MOTIONS OF WHICH PREVIOUS NOTICE HAS BEEN GIVEN

Nil

19. URGENT BUSINESS

20. CONFIDENTIAL MATTERS

Nil

21. CLOSURE