



CONSERVATION ACTION PLAN FOR THE SWAN-CANNING ESTUARY

November 2021



Department of Biodiversity,
Conservation and Attractions



This project is located on Whadjuk Noongar Country in the Derbal Yerrigan (Swan-Canning Estuary). We acknowledge the Whadjuk people as the Traditional Custodians of this waterway, and pay our respects to Elders past, present and emerging.

This Conservation Action Plan (CAP) and workshop was initiated by The Nature Conservancy Australia and led by independent conservation planning consultant, Paula Deegan.

Funding support was generously provided by the Minderoo Foundation; Lotterywest; the Department of Biodiversity, Conservation & Attractions and some of WA's most respected companies and philanthropists.



Contents

Summary	2
1. Introduction	3
2. Open Standards for the Practice of Conservation.....	5
3. The Swan-Canning Estuary: Background.....	7
3.1 Derbal Yerrigan - Whadjuk Noongar Country	7
3.2 Ecological setting.....	7
3.3 Social setting	8
3.4 Current planning and management.....	8
4. Conservation Action Planning for the Swan-Canning Estuary	9
4.1 Describing what we want to conserve: Scope, Vision, Assets.....	10
4.2 Understanding the current and desired condition of the assets	12
4.3 Identify and prioritise threats	13
4.4 Analyse the situation to identify goals and strategies.....	14
4.5 Potential strategies	14
5. Priority projects	15
5.1 Project identification.....	15
5.2 Project development; Defining theories of change and project summaries	17
Project 1: Increasing the extent and condition of foreshore and subtidal habitats	18
Project 2: Improving water quality by reducing nutrient contributions from the sediment	20
Project 3: Improving water quality by remediating legacy contamination sites	22
Project 4: Building greater capacity for community stewardship via development of a 'River Centre'	24
6. Next steps.....	26
Appendix 1: CAP Workshop invitees	27
Appendix 2: Pre-workshop survey questions and summary of responses.....	28
About TNC	37

Summary

This Conservation Action Plan (CAP) summarises the outcomes of a participative stakeholder workshop, hosted by The Nature Conservancy Australia (TNC), in July 2021.

The workshop aimed to prioritise a set of achievable, impactful projects for sustaining the ecosystem health of the Swan-Canning Estuary, canvassing information, expertise and views across the socio-ecological spectrum.

Stakeholders spanning government agencies (state and local), indigenous groups, industry, riverside businesses, community groups and research institutions were invited to contribute to the workshop and a preceding survey. Identification and planning of the key projects used an adaptation of the [Open Standards for the Practice of Conservation](#), a conservation planning and management process that is used globally.

The workshop did not attempt to develop a full conservation plan for the Swan-Canning Estuary, but instead drew from a review of existing plans and the knowledge of participants to look at gaps in current projects, build on past or current management activities, and/or address emerging issues.

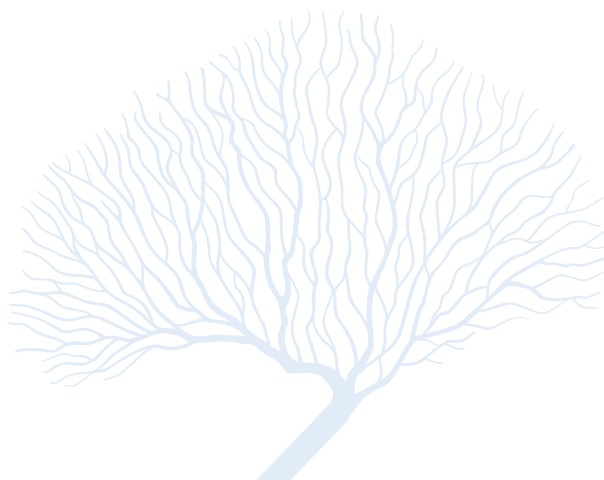
This Plan outlines each of these projects in more detail, including how they were prioritised, their broad goals, expected outcomes, key activities, potential partners, anticipated timelines and indicative budget.

It is anticipated that implementing any of these stakeholder-led projects will not only advance the estuary's health, but also the cross-sector collaborations, collective community ownership and long-term thinking that are fundamental to realising positive, effective outcomes for the Swan-Canning and the people that depend on it.

The Nature Conservancy Australia invites any interested parties to further develop and undertake these initiatives. We further seek to work in collaboration to help implement them and build on our existing habitat restoration projects in this iconic waterway.

The stakeholder group identified 22 potential strategies, which were discussed, reviewed and then developed into **four** large-scale projects.

- 1. Increasing the extent and condition of foreshore and subtidal habitats**
- 2. Improving water quality by reducing nutrient contributions from the sediment**
- 3. Improving water quality by remediating legacy contamination sites**
- 4. Building greater capacity for community stewardship via development of a 'River Centre'**



1. Introduction

This Conservation Action Plan (CAP) was developed from a workshop initiated by The Nature Conservancy Australia (TNC) in July 2021, which invited diverse stakeholders and community members (Appendix 1) to take part in prioritising a core set of projects for best sustaining the ecosystem health of *Derbal Yerrigan*, the Swan-Canning Estuary.

The focus was on feasible projects with the greatest impact in protecting key estuary assets and the widest stakeholder support, with areas of interest spanning the environmental, ecological, social and cultural spectrum.

Development of this Plan is part of a larger project being led by TNC in the Swan-Canning Estuary (2019-23) with the support of the Minderoo Foundation, Lotterywest, Department of Biodiversity, Conservation & Attractions, the Australian Government and some of WA's most respected companies and philanthropists. The main project objective is to help restore fundamental ecosystem functions to the estuary through rebuilding shellfish reefs, which were once abundant throughout this waterway.

Restoring these habitats will help improve local water quality through extensive biological filtration, boost fish productivity and enhance broader biodiversity. The restoration process also provides jobs for local industries and, as the reefs develop, encourages community to re-connect to their waterway. This reef restoration project is one of 13 nationally being led by TNC under the Australian Government's *Reef Builder* initiative to help recover a critically endangered coastal habitat and support local communities.

Aside from shellfish reef restoration, a further key objective of this project is to seek stakeholder-consensus on what other projects are most important for supporting the resilience of the Swan-Canning Estuary and the community connected to it. This is the key driver underlying this Conservation Action Plan.



Melville Water, Swan-Canning Estuary, looking towards Perth City © F. Valesini, TNC

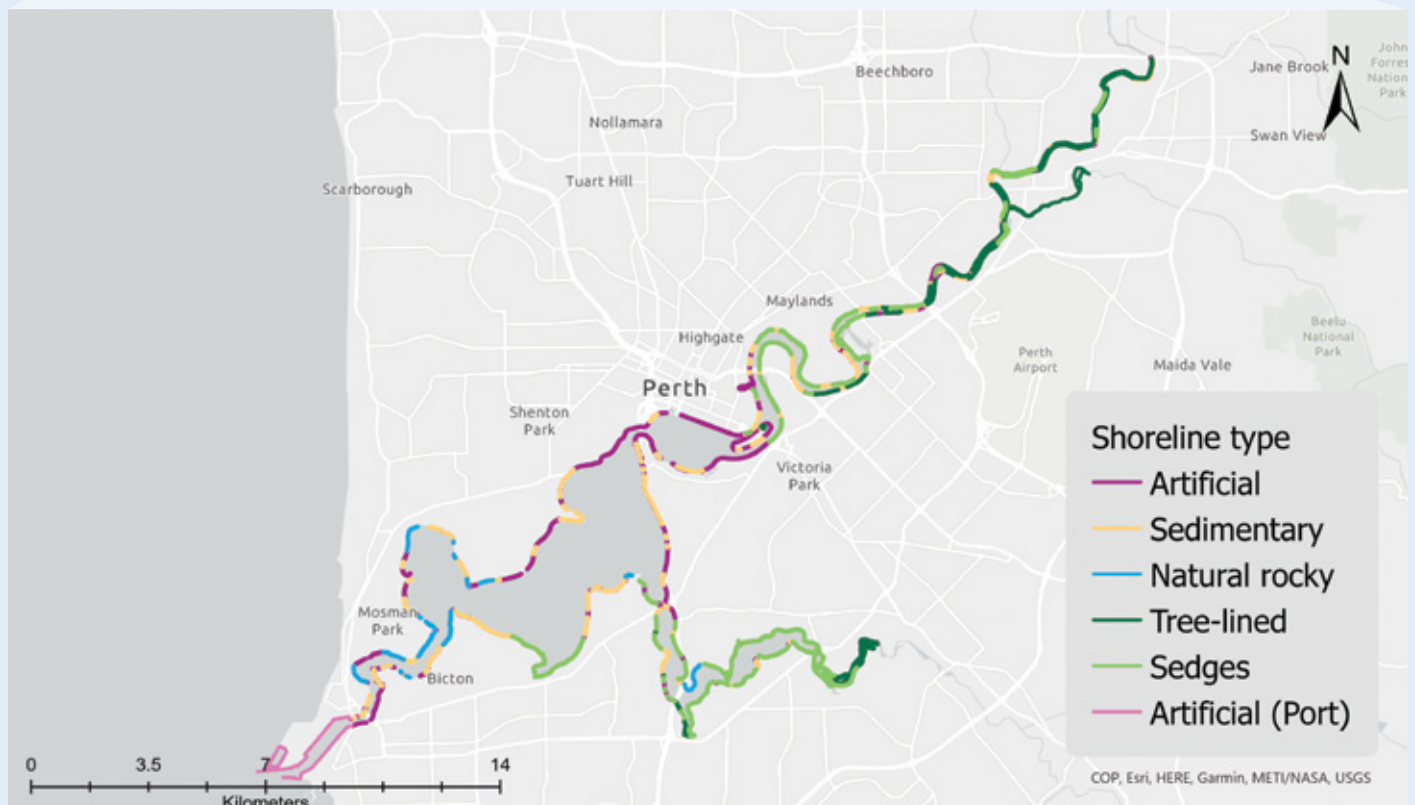


Figure 1. The focus area of the Swan-Canning Estuary for the CAP workshop. Original data source: Riverbank Data Set, Rivers and Estuaries Branch, Department of Biodiversity, Conservation and Attractions.

The CAP workshop concentrated on the receiving waters and immediate foreshores of the estuary (Fig. 1), while recognising that this environment is just one part of the wider continuum from catchment to sea. It is envisaged that the outcomes of this Plan could be connected with the activities of other groups or agencies with interests in ecosystem health across the broader, holistic spectrum.

There has been significant, long-term effort to plan and coordinate the management of the Swan-Canning waterway and its surrounding catchment.

A summary of this history and examples of some current relevant initiatives and projects were outlined in a Background Paper to the CAP workshop, which was provided to all participants. The workshop acknowledged and built on this base to identify where additional projects could best add value to current projects, fill knowledge or implementation gaps, or better connect across sectors. While the workshop focussed on ecosystem health outcomes for the estuary, the wider socio-ecological setting was considered and is reflected in the priority projects identified.



Woodward's Reef Eel, Freshwater Bay © S. Cossington, MAFRL

2. Open Standards for the Practice of Conservation

The *Open Standards for the Practice of Conservation* are a widely adopted set of principles and practices that bring together common concepts, approaches and terminology for conservation project design, management and monitoring.

Developed by the [Conservation Measures Partnership](#), a collaboration of global conservation practitioner and funder organisations, the process is designed to help conservation practitioners achieve lasting positive impact.

There are various adaptations of the Standards for use by different organisations and in different contexts, but all follow the same basic steps. In Australia, the Standards have been used since 2004, when TNC introduced its original version (Conservation Action Planning). A more recent adaptation developed in Australia, Healthy Country Planning, is now widely used throughout First Nations-managed land and seascapes, here and increasingly in other areas around the world including Canada, Asia, Africa and Oceania.

The main steps of the process are as follows, and are illustrated further in Fig. 2.

1. Summarise **what** you want to conserve (i.e. identify the **Vision, Scope, Assets**)
2. Understand the current and desired **condition** of the system
3. Identify and prioritise **threats**
4. Develop a **general model** of the system
5. Identify **goals and strategies** based on the general model
6. Define '**theories of change**' to show how the strategies will work
7. **Implement** the strategies and monitor
8. **Analyse, adapt and share** learnings

The Swan-Canning CAP workshop addressed steps 1-6 to develop the proposed strategies, and subsequently the key projects, which were considered most important by the stakeholder group.

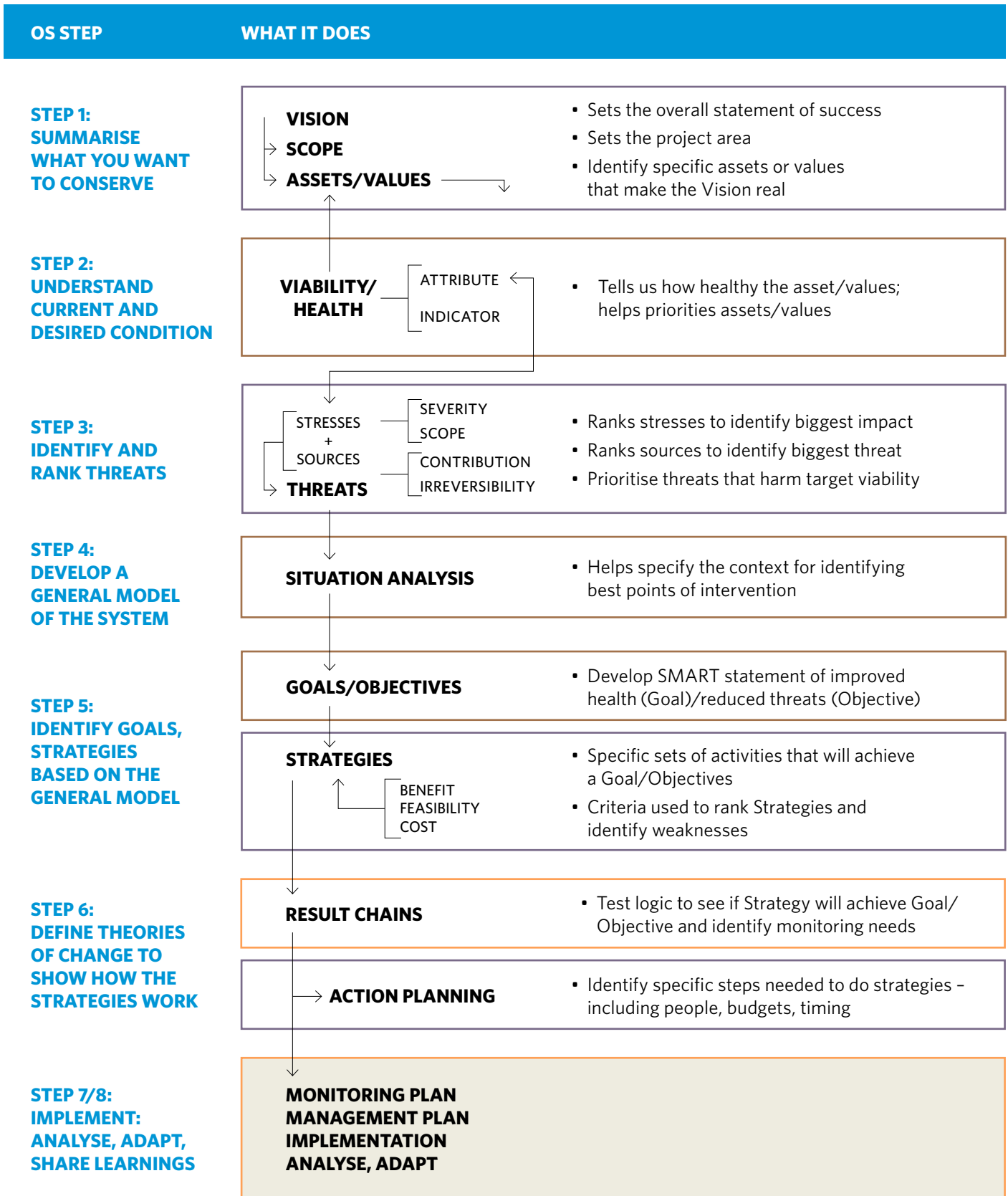


Figure 2: Overview of the Open Standards for the Practice of Conservation, and the first six steps undertaken for the Swan-Canning CAP.

3. The Swan-Canning Estuary: Background

3.1 Derbal Yerrigan – Whadjuk Noongar Country

Derbal Yerrigan, the Swan-Canning Estuary, is part of Whadjuk Noongar country. According to Whadjuk lore, *Derbal Yerrigan* was created by the dreamtime spirit rainbow serpent, the Wagyl, who emerged at Mt Eliza and created the river on its way to the ocean. Connected together, the Wagyl's trails form the shape of Whadjuk Boodjar (Whadjuk Country).

The deep spiritual bond between the Whadjuk Noongar people and their estuary has been built over more than 50,000 years. The estuary is a place of unity and bringing people together for food, family, healing and special ceremonies including births, weddings, funerals and other sacred rituals.¹

A current focus for Noongar people is embodied by [Danjoo Koorliny Walking Together Towards 2029 and Beyond](#). This is a bold, Aboriginal-led, systems-change project to help everyone walk together as Aboriginal and non-Aboriginal people, and co-create a better future for all. As part of the Danjoo Koorliny journey, there have been a series of events and festivals related to the health of the waterway and their connected landscapes, including the [Kep Water Symposium](#) in 2020. A further Water Symposium and a Danjoo Koorliny Summit are planned for 2021 as part of the walk towards a more holistic and culturally-based way of caring for land and water.

3.2 Ecological setting

Like other estuaries, the Swan-Canning has complicated environmental and ecological processes. The interaction of the freshwater flows from the Swan and Canning catchments and tidal intrusion from the Indian Ocean creates a diverse and dynamic array of habitats. In turn, this provides a productive, and at times challenging, ecosystem. This biodiverse waterway acts as a 'nursery' for the juveniles of many animal species, a permanent home for biota able to withstand its environmental changes, and a temporary refuge, feeding ground or transit route for animals that normally live at sea or in the rivers. The Swan Estuary Marine Park, an A-Class marine reserve encompassing three areas in the main receiving basin, was established in recognition of the estuary's ecological importance, particularly for waterbirds.

Some of the fauna inhabiting the Swan-Canning Estuary include a diverse fish community (100+ species), Blue Swimmer crabs, prawns (King prawn and Western School prawn), Indo-Pacific bottlenose dolphins, and 80+ species of resident and migratory waterbirds. Aquatic plants include seagrass beds and a diverse macroalgal community, as well as diverse riparian vegetation that fringes parts of the estuary, e.g. marshes, samphire, sedges and woodlands. Other less obvious biota, such as the small bottom-dwelling worms, crustaceans and shells and planktonic plants and animals, also represent fundamental parts of the estuary's ecology by providing rich food sources, decomposing detritus and/or recycling nutrients.²

¹ Perth Water Vision Group (2019). [Draft Perth Water Buneenboro Precinct Plan](#). Prepared for the Department of Biodiversity Conservation and Attractions.

² Brearley, A. (2006). *Ernest Hodgkin's Swanland: Estuaries and coastal lagoons of South-Western Australia*. UWA Publishing, Western Australia.



Point Walter, Bicton © F. Valesini, TNC

3.3 Social setting

The Swan-Canning waterway has been described as the defining feature of Perth.³ The location of the city on the shores of the estuary and the degree of public access to the waters and shorelines provides enormous benefits to residents (~2.1 million people) and visitors. Ensuring these benefits do not come at the cost of the ecological functioning of the system is an ongoing challenge.

The cultural, social, recreational and commercial benefits gained by Perth's residents and visitors from the estuary are enormous. For many residents, even those who may not regularly access the estuary, just its presence can contribute to a sense of well-being. It provides people with many on-water and foreshore activities including fishing, crabbing and prawning; paddle boarding, wind surfing, parasailing, canoeing and kayaking; sailing; power boating and water skiing; walking, running and cycling; bird watching and other wildlife observations; picnicking; cultural and social events; and participation in estuary restoration and conservation programs.

The agricultural, industrial and urban land uses within the surrounding catchments have contributed to water quality problems in the estuary over long time frames, mainly through the delivery of nutrients, other pollutants and organic matter. These high contaminant loads are often linked with depleted oxygen levels, harmful algal blooms, high turbidity and/or toxicity within the estuary, which in turn leads to other ecological impacts such as fish kills and the loss of other biota including birds and dolphins. The pressures of a considerable and growing urban population have also contributed to other threats, including invasive species, habitat removal and fishing pressure. Climate change impacts across south-western Australia bring a host of further stressors and complexities to the estuary's water quality, including through reduced freshwater flows, increased salinity, warmer temperatures, storm surge impacts and rising water levels.

3.4 Current planning and management

Some 15 State Government organisations, 21 local governments and various other natural resource management agencies have statutory roles or interests in maintaining the health of the Swan-Canning Estuary. It is influenced by more than 30 pieces of legislation, co-ordinated primarily by the Swan and Canning Rivers Management Act 2006. The Act created the 'Swan-Canning Riverpark', which includes the waters and foreshores of the Swan and Canning rivers and estuary, and defined two other management areas, the Development Control Area and the Swan-Canning Catchment. Under the Act, the Swan River Trust is vested with the care, control and management of the River reserve, and is responsible for developing policies and preparing and reporting on strategic documents relating to the Riverpark. This includes the [Swan Canning River Protection Strategy](#)⁴ (RPS) and reporting on its implementation to the Minister for Environment. The RPS, which was endorsed by the WA Government in 2015, aims to improve collaboration and coordination among the many organisations with responsibilities or interests in protecting the Riverpark.

The RPS (2015-2020) identified four key Riverpark values to be protected:

1. *Ecosystem health*, including water quality, environmental flows, biodiversity and foreshore condition. This was identified as the key value to be protected, as it underpins the other values for which the Riverpark is managed.
2. *Sense of place*, including the connection people have with the waterway related to their beliefs, traditions, memories and commitment to looking after them.
3. *Community benefit*, including aesthetics, recreational activities, community events and maintaining public access and safety.
4. *Economic benefit*, including commercial industries such as fishing, port-based activities and tourism, as well economic gain from proximity to the Riverpark, e.g. real-estate values, riverside business activity etc.

A [Biennial Report](#) providing a status update of the RPS was produced in 2018⁵, and a complete review of the RPS is currently underway with a public consultation phase due in 2021.

³ WALGA (2011). *Priority Plan for Investment in the Swan Canning Catchment*. Developed on behalf of the Swan Canning Policy Forum.

⁴ Department of Parks and Wildlife (2015). *Swan Canning River Protection Strategy*. State of Western Australia.

⁵ Department of Biodiversity, Conservation and Attractions, Rivers and Estuaries Branch (2019). *Swan Canning River Protection Strategy Biennial Report 2018*. State of Western Australia.



4. Conservation Action Planning for the Swan-Canning Estuary

The Nature Conservancy invited 100+ stakeholders from a broad cross section of the community to participate in the Swan-Canning CAP Workshop, including from state and local government, indigenous groups, industry representatives, riverside businesses, community groups and research institutions (Appendix 1).

The workshop was led by independent facilitator Paula Deegan, who has extensive experience in Conservation Planning, including 17 years using of the *Open Standards for the Practice of Conservation*.

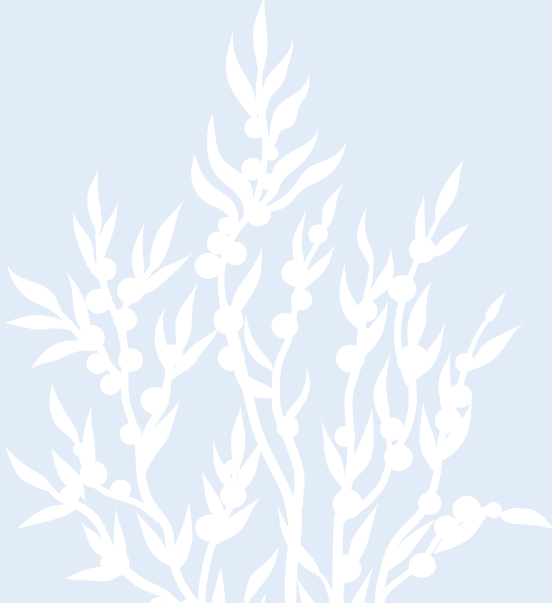
The main workshop purpose was to prioritise and co-design a set of projects to improve the ecosystem health of the Swan-Canning Estuary, with a focus on practical, impactful and widely-supported projects.

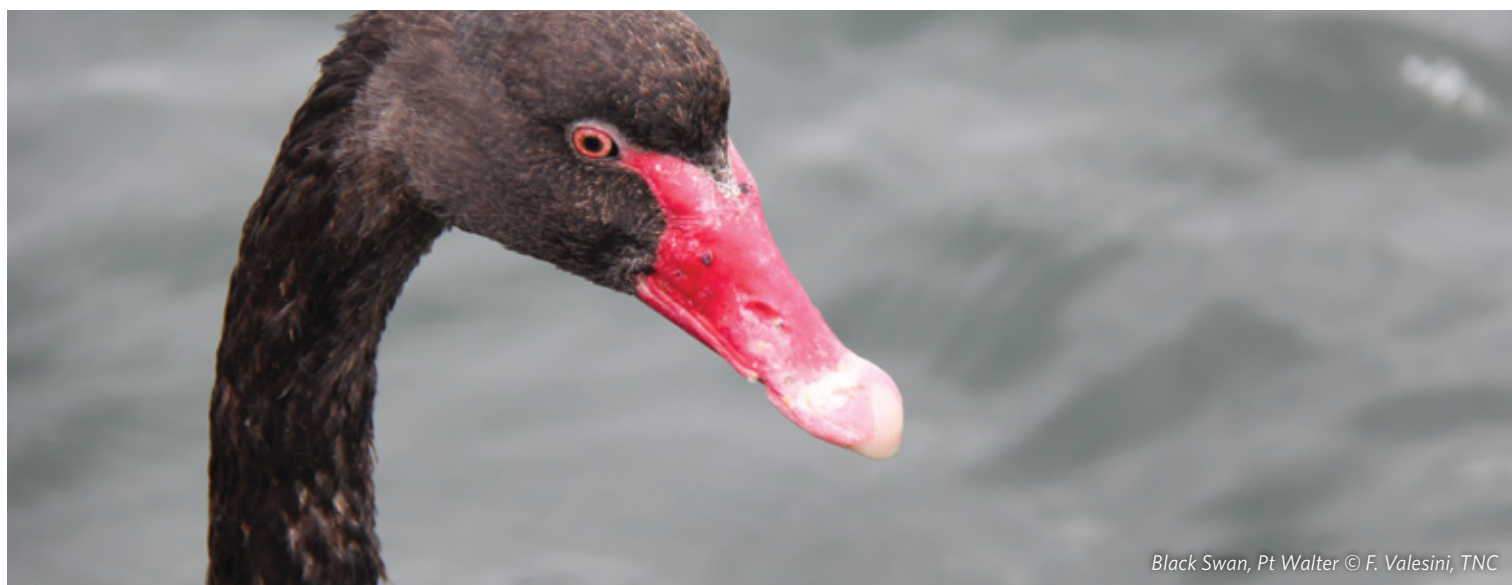
This face-to-face workshop was held over two days and was opened with a Welcome to Country by Whadjuk Noongar Elder Betty Garlett. Representatives from the Department of Biodiversity, Conservation and Attractions also provided an overview of the RPS and its current status. Day 1 of the workshop focussed on identifying the vision for the Swan-Canning Estuary, its key assets and their threats, and developing a shared understanding of the system. Day 2 focussed on identifying key strategies to practically address the threats, developing the representative priority projects, then defining the logic of how they're anticipated to work ('theories of change').

Prior to the CAP workshop, all invited stakeholders were sent an online survey asking for their views on their observed and desired changes in the estuary and suggested actions for improving its health (Appendix 2). These survey responses were used to guide the workshop structure. Workshop attendees were also provided with a preparatory Background Paper that summarised:

- i. Some of the cultural, socio-ecological and management context for the estuary;
- ii. Relevant projects undertaken in the last five years;
- iii. The geographical scope for the workshop discussion (i.e. Fig. 1);
- iv. Some of the key estuary assets and broad assessments of their condition, where known and;
- v. The approach to using the Open Standards for the Practice of Conservation.

Table 1: The key ecological and social/cultural assets of the Swan-Canning Estuary identified by CAP workshop participants.

ECOLOGICAL HEALTH AND RESILIENCE	SOCIAL AND CULTURAL CONNECTIONS
<p>Water</p> <ul style="list-style-type: none"> Quality and quantity <p>Habitat complexity</p> <p>Foreshore habits</p> <ul style="list-style-type: none"> Woodland Beaches Rocky foreshores Salt marshes <p>Benthic habitat</p> <ul style="list-style-type: none"> Seagrass beds Artificial structures <p>Endemic flora and fauna</p> <p>Floral diversity</p> <ul style="list-style-type: none"> Foreshore communities and species Subtidal benthic communities and species <p>Aquatic faunal diversity</p> <ul style="list-style-type: none"> Fish (pelagic and demersal) Shellfish Benthic invertebrates Dolphins Waterbirds <p>Terrestrial fauna</p> <ul style="list-style-type: none"> Native mammals Birdlife <p>Threatened species and communities</p>	<p>Socio-cultural</p> <ul style="list-style-type: none"> Whadjuk cultural practices, places & knowledge Ecologically-respectful access and diverse recreational use Community health (physical and mental) Awareness of human-environmental interactions Community participation in supporting estuary health (volunteer support) Visual amenity and sense of place (including landscapes, vistas) Sustainable economic use and livelihoods 



Black Swan, Pt Walter © F. Valesini, TNC

4.2 Understanding the current and desired condition of the assets

Prior to the workshop, some anticipated ecosystem and socio-economic assets of the Swan-Canning Estuary were identified in the Background Paper, and a preliminary assessment of their current condition was made using publicly-available and relatively recent (>2015) information or indicators (Table 2). These broad assessments were intended only to provide a starting point for discussion during the workshop. It should be noted that, while these assessments have been derived from reliable documentation, they have not been verified by relevant agencies and do not capture the complexity of how condition ratings may change over space and time in the estuary.

Given their broad scale, there were some difficulties during the workshop in applying these assessments to the current condition of some assets, particularly for those defined at a finer scale, e.g. individual habitats or species. **General stakeholder consensus, however, was that the ecological health of the estuary was in fair to poor condition overall.** Water quality and habitats (littoral/riparian and benthic) were considered to be in the poorest condition. The lack of fine-scale mapping of the extent and condition of the above habitats contributed to difficulties in reliably rating their condition, but it was clear that improvement was needed in all of these assets.

Table 2: Preliminary summary of some ecosystem and socio-economic assets of the Swan-Canning Estuary and, if available in the public domain, a rating of their condition status. *All condition assessments are unverified.

CATEGORY	ASSET	MEASURED	CONDITION*
Ecosystem	Water Quality		
	Dissolved Oxygen	Weekly - Public Reporting	Yellow
	Nutrients	Weekly - Public Reporting	Yellow
	pH	Weekly	Blank
	Salinity	Weekly - Public Reporting	Blank
	Chlorophyll a	Weekly - Public Reporting	Yellow
	Submerged Plants		
	Macroalgae extent and biomass	Annually to periodically	Blank
	Seagrass extent and biomass	Annually to periodically	Yellow
	Littoral/Riparian Vegetation		
	Community Index		Blank
	Natural shoreline extent	Catalogued - Publicly Available	Blank
	Invertebrates		
	Blue Swimmer Crab commercial catch	Annually - Public Reporting	Green
	Western School Prawn abundance		Red
	Community Index		Blank
	Fish		
	Community Index	Biannually - Public Reporting	Yellow
	Waterbirds		
	Species counts	Biannually - Community Surveys	Yellow
Dolphins			
Numbers of individuals and ID	Community Sightings	Blank	
Built Foreshore	Artificial Shoreline	Catalogued - Publicly Available	Blank
	Amenity	Catalogued - Publicly Available	Blank
	Access	Catalogued - Publicly Available	Blank
Recreation	Visitor Numbers	Annually - Public Reporting	Green
	Visitor Satisfaction	Annually - Public Reporting	Green
Commercial	Tourist Numbers/Satisfaction		Blank
	Riverfront Businesses	Catalogued	Blank
Cultural	Sites of Indigenous Significance	Mapped - Publicly Available	Blank

■ Good
 ■ Fair
 ■ Poor
 Blank = Not Ascertained

4.3 Identify and prioritise threats

The main threats to the key estuary assets in Table 1 were identified during the workshop and grouped (see below). The complexity of the ecosystem and the interacting nature of the threats meant that meaningful rankings were not able to be developed. However, poor water quality, structural modifications of foreshores and low community awareness of the consequences of human impacts were repeatedly identified as drivers of the main problems, and those in most need of further management.

Climate change impacts

- Rising sea levels
- Increased water temperatures
- Diminished rainfall (reduced river flows, reduced estuary flushing, vegetation stress etc)
- Increased salinity
- Intensity and frequency of extreme weather events
- Increased acidity of coastal waters
- Disease (e.g. linked with mosquito spread)

Declining water quality

- Nutrients (agricultural, industrial and urban sources)
- Non-nutrient pollutants
- Litter (plastics)
- Organic loading
- Low oxygen levels
- Algal blooms
- Contaminants from historical sources

Catchment development/population growth pressure

- Uncontrolled development (throughout the Swan-Avon and Canning river catchments, as well as the coastal plain catchment)
- Inadequate setbacks for developments
- Increased pressure from a growing population without a corresponding increase in understanding of the consequences for the estuary, or adequate mitigation strategies

Estuary-user impacts

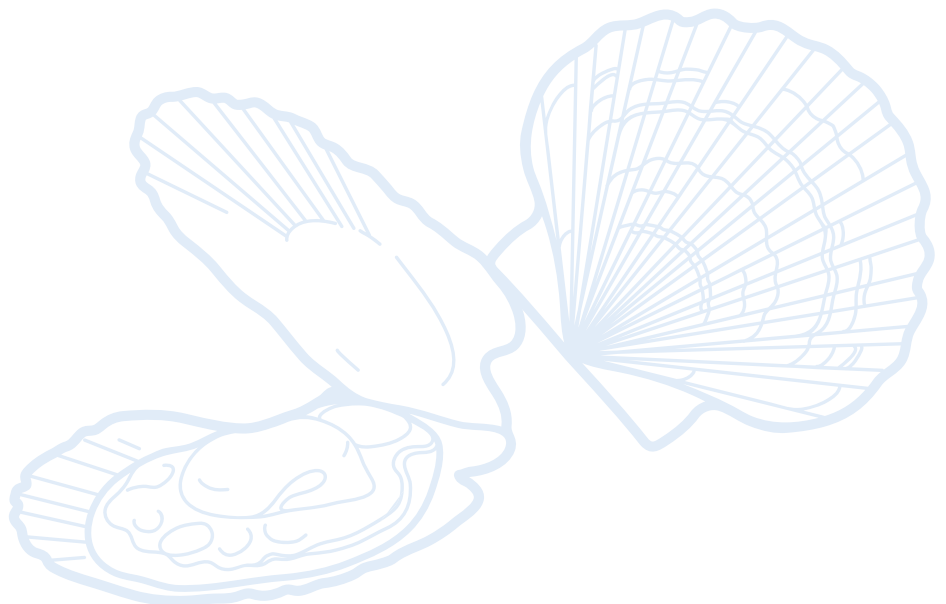
- Impacts of recreational activities on estuary ecology
- Human impacts on foreshores (e.g. trampling)
- Impacts of dogs and cats on shore-based wildlife
- Uncontrolled human access
- Community opposition to restrictions on their use of the estuary
- Low community awareness of their impacts on estuary ecology
- Over-fishing
- Discarded fishing lines

Modifications to the estuary bed and foreshores

- Hard river and sea walls
- Foreshore erosion
- Dredging

Other

- Invasive species
- Sedimentation
- Acid sulphate soils



4.4 Analyse the situation to identify goals and strategies

Workshop participants worked in groups to unpack the relationships between assets, threats and the factors contributing to those threats by developing 'situation models'. The use of these models to draw linkages between the above factors helped to identify 'intervention points' where strategies could be developed to mitigate threats and thus better protect the asset of interest. A simple example of one such model is shown in Fig. 3. In this diagram, the factors contributing to the direct threat of over-fishing (one of the pink rectangles) of demersal fish (the ecological asset – green oval) have been identified (orange rectangles), and two potential intervening strategies to address the key factors have been proposed (yellow hexagons). A full analysis would continue this process for each of the other direct threats (habitat loss, poor water quality, etc) to the asset.

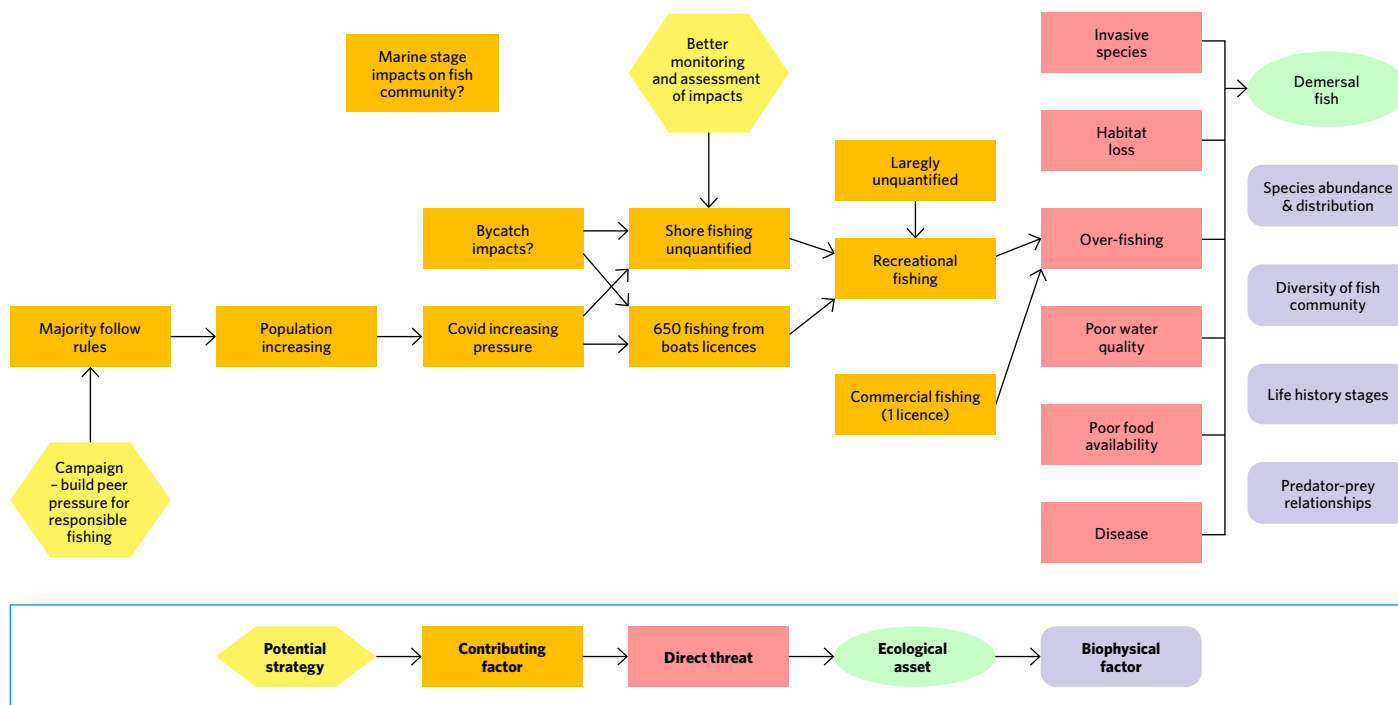


Figure 3: 'Situation model' for fishing impacts on demersal fish, with an explanatory key to diagram components.

4.5 Potential strategies

Following an initial session working on situation models in small groups, the participants came together in a larger group and identified the following list of **potential strategies**.

1. Formation or enhancement of riparian buffers
2. Detailed foreshore and benthic habitat mapping
3. Better protection for waterbirds (at Alfred Cove)
4. Restoration of beaches at Pelican Point
5. Investigation/remediation of boat wake at Pelican Point
6. Bioengineering for wave dissipation
7. Values/Threats mapping (understanding what's been done)
8. Restoration of benthic and foreshore habitats
9. Reduce nutrient contributions from the sediment to the overlying water
10. Macroalgae farming to remove nutrients
11. Monitoring of contaminants from rubbish tip sites
12. Restoration/revegetation of rubbish tip sites
13. Science/Art collaborations (for better education and connection)
14. Educational exhibition on historical ecology
15. Centre for the estuary (e.g. to link community education, provide a central source of knowledge etc)
16. Improve community connections to the estuary and reduce impacts from human use
17. Increased support for community groups
18. Protect and enhance dolphin populations
19. Increased Whadjuk management role, including Noongar rangers
20. Landscape and vista assessment, mapping and protection of visual connectivity
21. Behaviour change of fishers
22. Marine Parks to have increased protection status (i.e. Sanctuary Zones)

5. Priority projects

5.1 Project identification

Four large and long-term projects to better sustain the health of the Swan-Canning Estuary were identified from the potential strategies listed by the stakeholder group.

These projects were developed by combining similar and/or compatible strategies as follows:

1. **Increasing the extent and condition of foreshore and subtidal habitats** (strategies 1-8)
2. **Improving water quality by reducing nutrient contributions from the sediment** (strategy 9)
3. **Improving water quality by remediating legacy contamination sites** (strategies 11-12)
4. **Building greater capacity for community stewardship via development of a 'River Centre'** (strategies 13-18)

While all 22 of these strategies were considered priorities, some were not developed further as projects for various reasons.

Strategy 19 was strongly supported, but as no Whadjuk representatives were able to attend the CAP workshop, it was not appropriate to further develop this strategy within this forum. Instead, workshop participants agreed to support Whadjuk and other Noongar desires for greater inclusion at all levels of decision-making and management regarding the health of the estuary. Whadjuk cultural knowledge and practices were also recognised as having a vital role to play in shaping the community stewardship that is crucial to the future of the estuary (Project 4).

Strategies 10 and 20-22 were unable to be developed further during the workshop due to time constraints, but have been briefly outlined below.

Macroalgae farming to reduce nutrients

Reducing excessive nutrient inputs to the Swan-Canning Estuary is among the highest of the priorities for managing the system. In addition to the current catchment and waterway management approaches aimed at reducing nutrient flows to the estuary, other innovative ways to strip nutrients from the water and sediments are needed to help maintain ecological health. Exploring ways that this can be done while potentially providing other benefits such as additional habitat diversity or useful products should be encouraged.

This proposal includes investigation of potential macroalgal species that could be 'farmed' within the estuary to help reduce bioavailable nutrients, provide new habitat for fish and invertebrates and boost overall biodiversity. Project development would need to include:

- Identification of species that are fast-growing, do not pose a biosecurity risk, can provide additional habitat for fish or other aquatic biota, can be harvested, and can be disposed of safely and/or used for other purposes post-harvesting (e.g. as fertiliser, mulch or as an edible product)
- Identification and assessment of site suitability for macroalgal growth and minimal/acceptable impacts on other estuarine users
- Pilot trials
- Cost-benefit analysis to determine whether the resulting nutrient removal is impactful and cost-effective at full-scale development.
- Permitting and approvals pathways



CAP Workshop participants © F. Valesini, TNC

Landscape and vista assessment, mapping and protection of visual amenity

Workshop participants noted there is currently no overarching mechanism that allows visual amenity along the estuary to be protected. Developments are assessed under an array of statutory measures, but generally on a site-by-site basis and with insufficient consideration of the estuary and its vistas as a public asset. Consequently, the land- and river-scapes are subject to 'death by a thousand cuts' and, once lost, are very difficult to recover.

There are well developed methodologies available for identifying and mapping landscapes and vistas, variously known as Visual Landscape Quality Assessment, Visual Resource Management or similar⁶. The methodology for mapping is applied in National Parks in several states in Australia, including in WA where it has been used for planning park infrastructure. In 2007, the WA Planning Commission and the (then) Department of Infrastructure and Planning produced the guidelines, '[Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design](#)', which were aimed mostly at encouraging site developers to include visual impact assessment in their designs.

A more pro-active approach is taken in parts of Britain and other parts of Europe where the methodology is used as part of legally-enforced landscape and cultural heritage protection. This approach is what is proposed for the Swan-Canning Estuary under this proposal.

The project would include:

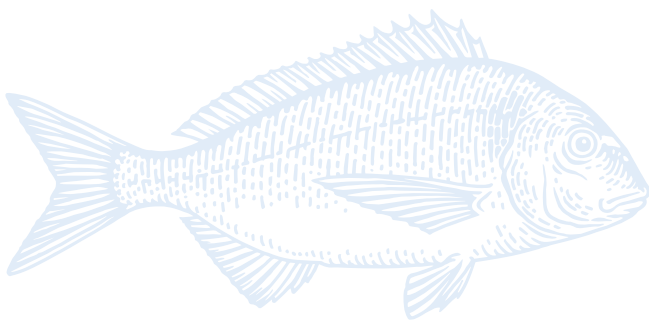
- Review and assessment of methodologies for vista and landscape assessment
- Review of existing statutory planning and development assessment mechanisms for protection of landscapes, riverscapes and vistas
- Application of methodology to the Swan-Canning Estuary
- Community consultation on preliminary proposals for protection
- Recommendations and implementation of protection measures.

Behaviour change of fishers

While this project was discussed in less detail, the underlying rationale is the observed rapid increase in fisher numbers within the estuary, particularly during the past 18 months of restricted travel due to the COVID-19 pandemic. Some workshop participants were concerned that some fishers have limited appreciation of their responsibilities towards the ecology of the estuary, or towards fellow estuary users. It was also raised that while boat-based recreational fishing is licensed, there is no monitoring of shore-based fisher numbers or their catch.

The project would include:

- Surveys of the numbers, knowledge and behaviours of fishers (shore and boat-based) within the estuary
- Targeted communications to increase awareness of ecologically-appropriate behaviours
- Enlisting recreational fishing groups and individuals as key peers to drive the project and provide education and training
- Introduction of no-take zones within the Marine Park.



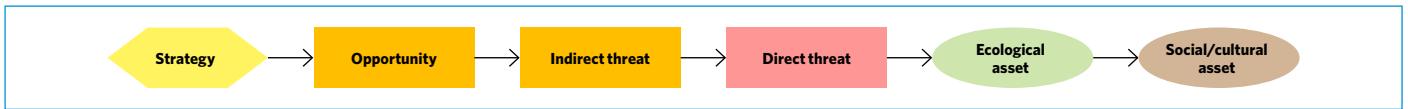
⁶ See for example:

- [Keles, E., Atik, D., & Bayrak, G. \(2018\). Visual Landscape Quality Assessment in Historical Cultural Landscape Areas. European Journal of Sustainable Development, 7, 287-300; 10.14207/ejsd.2018.v7n3p287-300.](#)
- [Franch-Pardo, I., Cancer-Pomar, L., Napoletano, B. \(2017\). Visibility analysis and landscape evaluation in Martin river cultural park \(Aragon, Spain\) integrating biophysical and visual units, Journal of Maps, 13, 415-424; 10.1080/17445647.2017.1319881](#)
- [Department of Planning and Development and Planisphere \(2013\). South West Victoria Landscape Assessment Study. Regional Overview Report. Executive Summary.](#)

5.2 Project development; Defining theories of change and project summaries

Workshop participants worked in groups to develop the priority projects by defining 'theories of change' to show how the strategies are intended to work. This was done by producing 'results chains' based on the situation analyses outlined in section 4.4. The results chains show the sequence of activities and their anticipated outcomes, both in the short and longer term. The relationships between the factors of a situation analysis and a results chain are illustrated in Fig. 4.

Situation model shows the current state



Results chain shows the anticipated future state

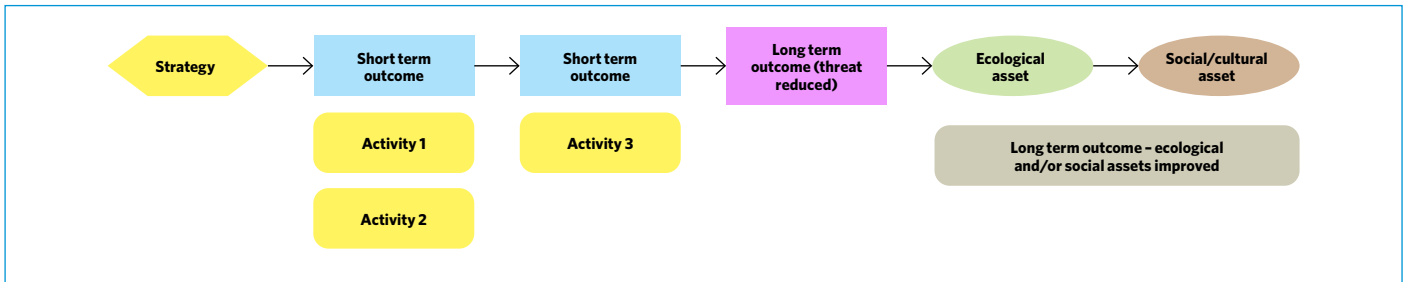
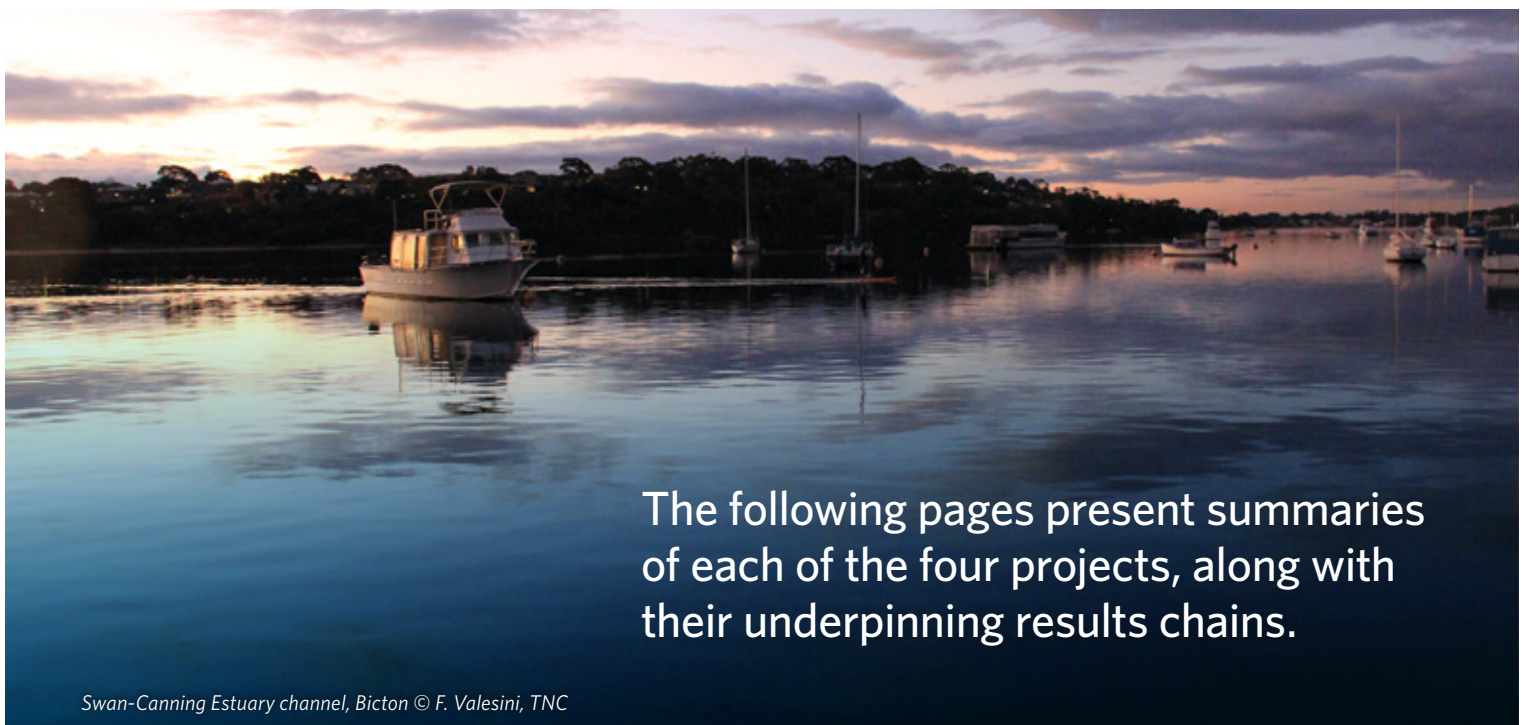


Figure 4: Conceptual illustration of how results chains are derived from the situation model.

Discussions between participants in each group as they developed their results chains resulted in the following summaries of the four priority projects. Each summary was structured around the sub-headings below.

- A brief description of the project and why it is needed
- Anticipated long-term outcomes
- Expected short-term outcomes
- Key activities
- Potential partners
- Broad timeline and anticipated budget.



The following pages present summaries of each of the four projects, along with their underpinning results chains.

PROJECT 1:

Increasing the extent and condition of foreshore and subtidal habitats

Why is this project a priority?

Foreshore and benthic habitats have been dramatically reduced in their extent, diversity and condition by decades of stressors, including population and development pressure, poor water quality and climate change effects. For example, foreshore development and infrastructure has physically displaced natural riparian habitat, while changing water flow dynamics, wave energy dissipation, water quality and sediment dynamics have resulted in a range of negative impacts for fringing vegetation, sand/mud flats and subtidal habitats such as seagrass. This means the remaining areas of natural habitat are more susceptible to disturbances such as erosion, trampling by people and domestic pets, and invasive species. Loss of these habitat types has a range of ecological consequences, such as reductions in food and shelter for birdlife and fish.

What will the project do?

The project will firstly conduct a fine-scale assessment of the current foreshore and benthic habitats to determine the constraints and opportunities for various habitat improvement options, including bioremediation of banks, augmentation of existing habitat areas and revegetation of both foreshores and subtidal habitats. As well as physical and tenure constraints, the project will identify where statutory reforms may be necessary. Pilot trials will then be conducted at a number of priority sites and evaluated as to their suitability for wider implementation.

Long-term outcomes from this project

- Stabilisation and restoration of beaches and riparian vegetation (including within known, ecologically-important areas such as the Marine Park, e.g. Pelican Point)
- Improved extent and condition of habitat for birdlife (including potential development of bird sanctuaries)
- Enhanced diversity of flora and other fauna (e.g. fish and invertebrates) across the estuary as habitat areas and conditions are improved.
- Improved community understanding of the importance of foreshore and subtidal habitats for estuary health, and subsequent motivation for positive behaviour change

Short-term outcomes

- Increased understanding of habitat extent and condition (from fine-scale habitat mapping)
- Multi-criteria analysis to identify priority habitats for restoration
- Understanding of constraints on restoration
- Improved understanding of effectiveness of bioremediation and habitat augmentation methods

Key activities

- Fine-scale mapping of foreshore and subtidal benthic habitat types and condition
- Multi-criteria analysis to determine priority sites and habitats for restoration
- Identify constraints on and opportunities for restoration based on the above analysis and develop solutions
- Pilot site identification, stakeholder and community consultation, acquisition of permits and approvals, and implementation of trials
- Monitoring, evaluation and reporting of trial outcomes, with adaptation as required
- Planning and consultation on wider roll out
- Training and resourcing of community groups and individuals to assist with implementation and monitoring, where feasible

Potential partners

- DBCA
- DWER
- Local governments
- Universities, other research organisations
- Community groups (e.g. SERCUL, SERAG, River Guardians)
- Perth NRM

Project 1: Increasing the extent and condition of foreshore and subtidal habitats: Theory of change



ANTICIPATED TIMELINE	
Stage 1	
Planning; Mapping; Consultation; Pilot site selection; Approvals; Implementation of habitat improvements at pilot sites; Monitoring and evaluation	2-4 years
Stage 2	
Full-scale habitat restoration at priority sites. Development and implementation of ongoing monitoring, evaluation and reporting of habitat condition	~10 years (depending on the number of priority sites and complexity of restoration process)
INDICATIVE BUDGET	
Stage 1	
Planning, mapping, consultation, identification of priority sites and approvals	\$500,000 - \$1,000,000
Habitat implementation, monitoring and evaluation at pilot sites	\$1M-\$5M (depending on site extent and complexity)
Stage 2	
Unable to estimate costs until Stage 1 is completed	

PROJECT 2:

Improving water quality by reducing nutrient contributions from the sediment

Why is this project a priority?

Healthy sediments are a vital part of the estuarine ecosystem. Decades of sediment, contaminant (nutrient and non-nutrient) and organic matter inputs from the catchment, plus within-estuary contributions, have resulted in highly-enriched, muddy and easily-suspended sediments, especially in deeper and low flow areas of the estuary. Contaminant release from the sediments into the water column can undo the benefits of other management actions aimed at water quality improvement. Sediment deposition within the estuary, particularly after high flow events, can kill or degrade seagrass beds and other benthic habitats. While limiting the sediment and contaminant loading into the estuary is an ongoing priority, understanding where and what effect legacy sediment accumulations are having on estuarine health, and determining if there are safe options for their removal, is the rationale for this project.

What will the project do?

The project will firstly review the state of understanding of the sediment contamination loads in the estuary. It will then undertake site investigations to identify the contaminants present and the impacts on local water quality and biotic conditions. Potential sediment removal, remediation or 'no action' options will be identified and a cost-benefit analysis undertaken. For those sites where sediment removal or remediation is deemed feasible, cost-effective and impactful, the appropriate restoration actions will be applied. A monitoring and evaluation program will be established to examine any negative impacts on other ecosystem components via activities such as dredging. In-field trials and monitoring will initially be undertaken at a pilot scale and, if deemed feasible, followed by full-scale implementation.

Long-term outcomes from this project

- Improved benthic habitats
- Improved water quality, including reduced contributions from sediments to nutrient loads, anoxia, algal blooms and fish kills.

- Greater recreational benefits, including fishing, wildlife watching, water-sports and general amenity
- Greater commercial benefits including fishing, ecotourism and riverside businesses.

Short-term outcomes

- Improved understanding of the nature of sediment contamination loads throughout the estuary
- Increased understanding of potential remediation options, benefits and costs (with particular focus on cost of dredge material reuse and/or disposal)
- Increased understanding of the impacts of dredging and other sediment removal approaches on nutrient and other contaminant dynamics in the estuary

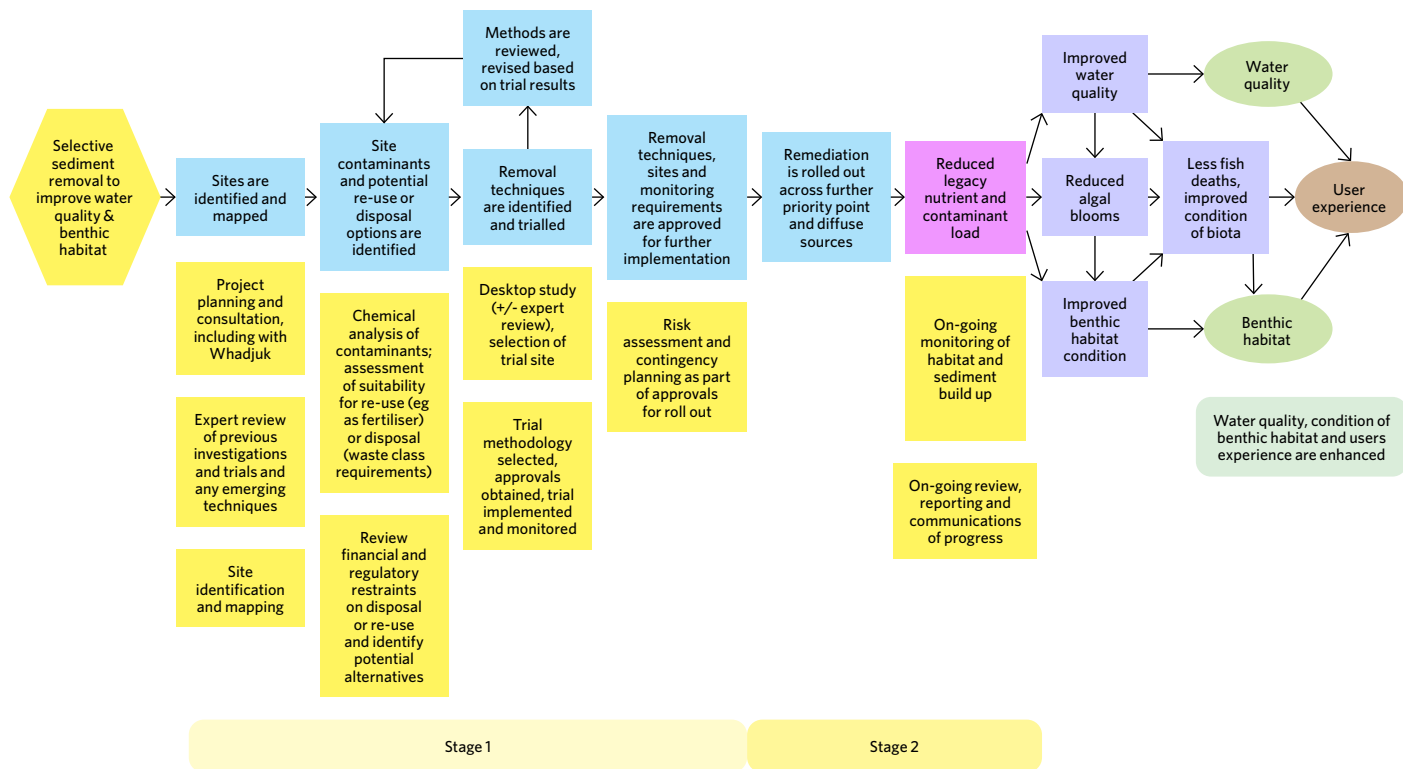
Key activities

- Collation and review of previous sediment studies within the Swan-Canning Estuary, and in other comparable systems where similar remediation has been attempted
- Priority site identification and mapping
- Sediment analysis
- Investigation of the potential to re-use removed sediment or specific components
- Investigation of sediment disposal options and implications
- Development and trial of sediment removal techniques
- Monitoring, evaluation and review of pilot trials
- Wider implementation if proven feasible

Potential partners

- DBCA
- DWER
- Local governments
- Universities, other research organisations

Project 2: Improving water quality by reducing nutrient contributions from the sediment: Theory of change



ANTICIPATED TIMELINE

Stage 1

Planning; Consultation; Review of other studies; Investigation of re-use/disposal options; Pilot site implementation, monitoring and evaluation

3-5 years

Stage 2

On-going implementation at priority sites is dependent on results of Stage 1, but is anticipated to require ~10 years. Regular monitoring, evaluation and reporting should be on-going

~10 years

INDICATIVE BUDGET

Stage 1

Approximately \$1,000,000 per year, depending on sediment removal, re-use and disposal methods and size of the pilot sites

\$3M-5M

Stage 2

Unable to estimate costs until Stage 1 is completed

PROJECT 3:

Improving water quality by remediating legacy contamination sites

Why is this project a priority?

Many former waste disposal sites throughout the catchment continue to pose a risk to the estuary through leaching of nutrients and other contaminants via groundwater or direct runoff. Other sites are the former locations of industries that produced various contaminants, including heavy metals. Most, but possibly not all, of those sites will be included in DWER's contaminated sites register. The extent, chemical composition and rate of movement of contaminants is not known for all sites, and the impact on the estuary is therefore not clear. Where leachates have not yet reached the estuary, options for removal and/or the implementation of barriers/buffers are needed.

What will the project do?

The project will first review available information to identify sites that may not yet be on DWER's contaminated sites database. All sites will then be assessed based on available information, and for sites deemed high risk, further assessments will be undertaken through soil and groundwater sampling and mapping of flow paths. Potential remediation methods will be reviewed, with an emphasis on identifying those that are most applicable at the highest priority sites. Novel remediation methods, for example through microbial reduction, will be also considered. Pilot treatment sites will be identified, remediation techniques trialled, monitored and evaluated before potential wider-scale implementation.

Long term outcomes from this project

- Improved water and sediment quality
- Improved benthic and foreshore habitat condition
- Improved health of estuarine biota
- Reduced potential for bioaccumulation of harmful toxins, including to humans
- Potential for former industry/disposal sites to be remediated and developed into restored foreshore habitats and/or recreation areas

Short term outcomes

- Increased understanding of contaminated sites and their impacts on the estuarine ecosystem
- Improved understanding of remediation techniques and their costs
- Improved monitoring and evaluation of potential contamination 'hot spots'

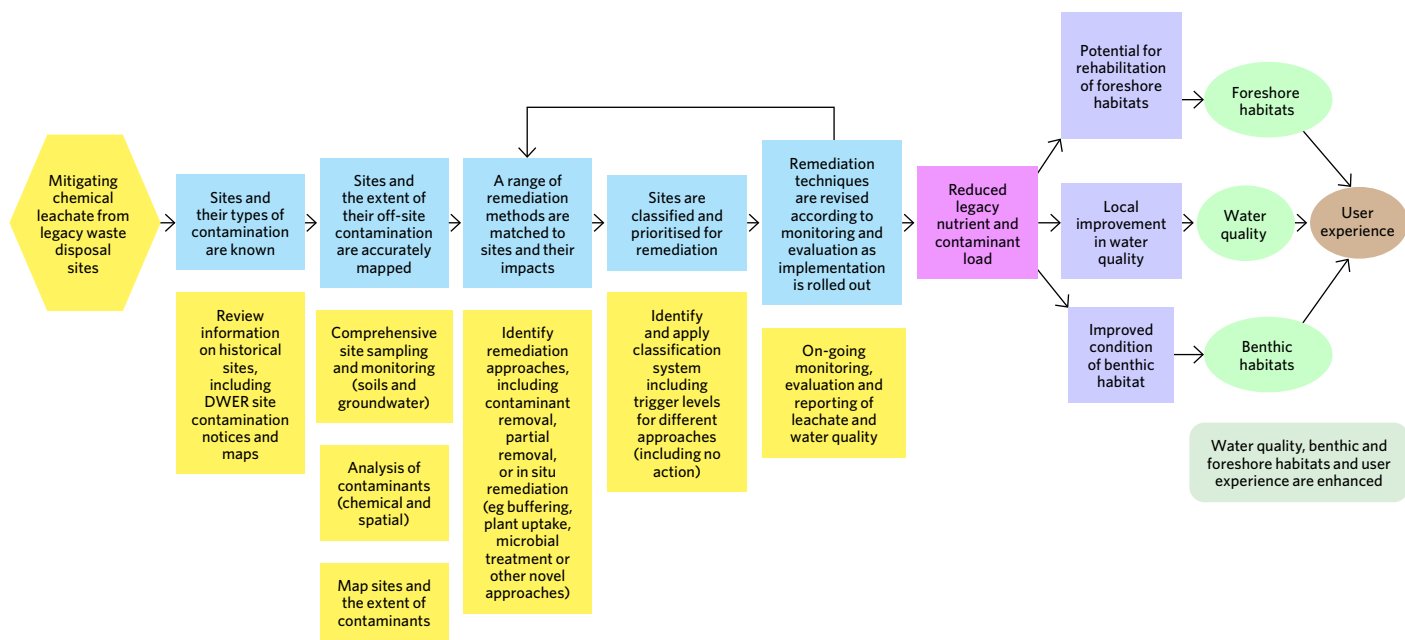
Key activities

- Review available information on historical contamination sites
- Testing of soil and groundwater for contaminant and flow characteristics at priority sites
- Review and undertake a cost-benefit analysis of potential remediation techniques, including novel approaches, to develop a suite of remediation options
- Classify and prioritise sites for remediation
- Apply remediation technique(s) at pilot sites
- Monitoring, review and further remediation, depending on outcome of pilot trials

Potential partners

- DBCA
- DWER
- Local governments
- Relevant industries
- Universities, other research organisations

Project 3. Improving water quality by remediating legacy contamination sites: Theory of change



ANTICIPATED TIMELINE

Stage 1

Planning; Consultation; Review of available information and remediation options; Pilot site selection, implementation monitoring and evaluation

3-5 years

Stage 2

Wider-scale remediation at priority sites is dependent on the outcomes of Stage 1. If feasible, further remediation is anticipated to require ~10 years. Monitoring, evaluation and reporting should be on-going

~10 years

INDICATIVE BUDGET

Stage 1

Approximately \$1,000,000 per year, depending on remediation method and size of pilot sites

\$3M-5M

Stage 2

Unable to estimate costs until Stage 1 is completed

PROJECT 4:

Building greater capacity for community stewardship via development of a 'River Centre'

Why is this project a priority?

While there has been an increase in community awareness and understanding of environmental issues in the estuary over recent decades, human impacts continue to grow. With rising populations of both residents and visitors, demands and expectations are also rising and conflicts are likely to continue. Additionally, climate change impacts including sea level rise, reduced river flows and increasing water temperatures, are exacerbating other human use pressures. Without a long-term commitment and engagement by the wider Perth community, the host of environmental and social benefits that the Swan-Canning provides will not be available to future generations. Rather than accepting continuing degradation of the estuary, this project aims to raise the bar and place caring for the estuary at the centre of Perth's consciousness.

What will the project do?

The project will initially engage influential individuals ('champions') from across cultural, artistic, scientific, educational, community and industry sectors to build a strong 'Friends of the River' network. The group will advocate for a bipartisan, long-term commitment to improving community ownership, understanding and stewardship of the estuary. This will include initiating arts/science projects for increasing understanding of the estuary and build support for a 'River Centre'. The Centre will house and coordinate knowledge and resources to foster and support ongoing community stewardship for the estuary.

Long term outcomes from this project

- A Perth community that is more aware of, and connected to, the needs and benefits of a healthy and resilient Swan-Canning Estuary, e.g. its values, pressures and what is needed to sustain it into the future
- Greater active participation by the wider community in estuary protection and remediation initiatives
- A 'River Centre' on the estuary's shores that will be a physical hub for information, research, learning, community action, arts and cultural events related to the estuary and its history – from the creation of Derbarl Yerrigan by the Wagyl to its future
- A healthier and more respected estuarine ecosystem

Short term outcomes

- An influential and enthusiastic 'Friends of the River' network to coordinate and build support for the River Centre
- Stronger bonds between artists, writers, scientists, community volunteers, industries and all levels of government committed to the health of the estuary
- Greater community participation in volunteer groups and events

Key activities

- Consultation with potential partners and development of a collaborative working and leadership framework
- Identify 'champions' to represent the estuary and proposed River Centre, and form a 'Friends of the River' network
- Develop and implement a communication and engagement strategy
- Hold a 'Swan-Canning Estuary Forum' with multi-sector presentations and awareness-raising events to canvas and build support for the Centre
- Develop and implement long-term and sustainable fund-raising strategies to support the Centre
- Secure commitments, site and design for the Centre

Potential partners

- Danjoo Koorliny
- Perth Vision
- WA Museum
- Arts industry (FORM)
- Festival of Perth
- Local and state governments
- Universities and other research organisations
- Philanthropists
- Historians
- Recreation groups, yacht clubs, fishers

Project 4. Building greater capacity for community stewardship



ANTICIPATED TIMELINE

Stage 1

Planning; Consultation; Building support and scoping initial funding options; Community engagement and holding initial events, including the Swan-Canning Estuary Forum

3-5 years

Stage 2

Building on momentum of Stage 1; Securing funding support and other commitments, permits and approvals for the Centre; Centre design, development and construction

3-5 years

INDICATIVE BUDGET

Stage 1

Approximately \$1,000,000

\$1M

Stage 2

Unable to estimate costs until Stage 1 is successfully completed

6. Next steps

The Nature Conservancy Australia invites any interested parties to further develop and undertake the four initiatives prioritised during the Swan-Canning CAP workshop.

Given the scale of these initiatives, cross-cutting collaboration among agencies and sectors will be essential to their success and maximising the far-reaching outcomes for both people and nature.

We further seek to work in partnership to help implement these projects and build on our existing habitat restoration work in this iconic waterway.



Appendix 1:

CAP workshop invitees

INVITEES	ATTENDEES
Government Members	✓
State Government	
Department of Biodiversity, Conservation and Attractions (DBCA)	✓
Swan River Trust (SRT)	✓
Department of Primary Industries and Regional Development (DPIRD)	
Department of Transport (DOT)	
Department of Water and Environmental Regulation (DWER)	
Department of Planning, Lands and Heritage (DPLH)	
Main Roads WA	
Local Government	
City of Fremantle	
Town of Bassendean	
Town of East Fremantle	
City of Swan	✓
City of Melville	✓
City of Swan	
City of Canning	✓
City of Belmont	
City of Perth	
City of Nedlands	
Western Australian Local Government Association	
Town of Claremont	
Town of East Vic Park	
Shire of Peppermint Grove	
City of South Perth	
Town of Mosman Park	
Town of Vincent	
City of Bayswater	
Indigenous agencies and representatives	
South-west Aboriginal Land and Sea Council	
Danjoo Koorliny	
Individual representatives	
Project Donors	
Minderoo	✓
Lotterywest	
Individuals	✓

INVITEES	ATTENDEES
Commercial Fishing Groups	
Western Australian Fishing Industry Council (WAFIC)	✓
Individual commercial fishers	
Recreational Fishing Groups	
OzFish	
Recfishwest	
Community Groups & local representatives	
Perth Region NRM	✓
River Guardians	✓
South East Regional Centre for Urban Landcare (SERCUL)	✓
Swan Estuary Reserves Action Group (SERAG)	✓
Local community representatives	✓
Local Riverside Businesses	
Dive clubs	
Canoe clubs	
Water Ski clubs	
Kiteboarding clubs	
Rowing clubs	
Scout clubs	
Yacht Clubs	
Royal Perth Yacht Club	✓
South of Perth Yacht Club	
Royal Freshwater Bay	
Mounts Bay Sailing Club	
East Fremantle Yacht Club	
Perth Flying Squadron Yacht Club Inc	
Yachting WA	
Claremont Yacht Club	
Nedlands Yacht Club	
Universities	
Murdoch University	✓
University of Western Australia (UWA)	
Edith Cowan University (ECU)	
Curtin University	
Consultants	
Conservation Not-For-Profits	
The Nature Conservancy	✓

Appendix 2:

Pre-workshop survey questions and summary of responses

All participants that were invited to the workshop were asked to complete and submit an anonymous survey via an online platform. The survey was intended to capture stakeholder experiences and views of the Swan-Canning Estuary, and their thoughts on how it can be improved.

The survey questions are provided below, along with a summary of the responses that were received (17). Responses have been summarised and grouped under common themes.

Q1 What changes for the BETTER have you seen in the health of the Swan-Canning Estuary?

Foreshores and vegetation

- Rehabilitation of the native vegetation fringing the estuary and the vegetation in streams flowing into the estuary
- Re-establishment of the fringing vegetation and the upgrade of community views to appreciate the river
- Improved amenity of the foreshores
- More riverbank works including revegetation and natural materials
- Increased focus on the importance of natural areas
- Improvements to sections of the foreshore, which have enhanced their landscape, environmental and passive recreational value, e.g. Point Walter, work underway at Alfred Cove, the western foreshore of the Canning north of Mt Henry Bridge, Miller's Pool, replacement of turf with local native plants on Shelley-Rossmoyne foreshore

Other biodiversity

- Significant increase in Black swans on the Canning and possible increase in the Eastern osprey
- Better management of the Australian Fairy Tern colony at Point Walter

Water quality

- Infrequent algae blooms - improved wildlife
- Less fish kills, good crab numbers, less fishing line waste
- Less algal blooms
- Improved drainage controls into the river
- Water quality appears to have improved in the Melville Water area
- No change. Algal blooms have been seen in the last 8 years. Did not think it was in bad health before or now, although I am aware of risks more now.

Community involvement, awareness

- Greater involvement of community groups, ENGO's and government agencies applying adaptive management strategies to address social and ecological issues
- Better engagement with Noongar authorities and more opportunities for historical and scientific understanding of the River's character, history, and significance
- Better community awareness and ownership of the rivers and foreshores

Recreation

- More passive recreational activity - sailing, walking, cycling and canoeing

Management

- Research outcomes leading to on-ground improvements (e.g. more of a regional and systems approach to river management being taken (Water Quality Improvement Plans etc), improvements in the design of foreshore protection works, vessel speed reductions, community awareness raising on water quality issues
- Better use of flood zones

Other comments

- There has been some work on managing/restoring natural estuary margins by volunteer groups and local governments and efforts to manage water quality or reintroduce species, but the same issues/threats remain, exacerbated by climate change and the lack of interest of decision makers and the ecology is 'just hanging on'. Threats:
 - clearing and fragmentation;
 - disturbance pressures from recreation;
 - 'land-reclamation' or infilling;
 - altered hydrology/tidal restrictions, such as river-walls and revetments that cause benthic 'scouring';
 - invasive species of flora and fauna;
 - contamination, pollution and litter;
 - eutrophication;
 - acid sulfate soils;
 - pesticides, and
 - the impact of climate change.

Q2 What changes for the WORSE have you seen in the health of the Swan-Canning Estuary?

Foreshores and vegetation

- Some loss of parkland fringing the estuary to residential and commercial development
- Erosion of banks along the Canning River and loss of trees
- Increase in hard structures along the banks of the Swan
- Loss of fringing vegetation
- Increased erosion of river banks
- Reduction in birdlife and access to the foreshore
- Increasing impacts on river environments: climate change, weather events, loss of vegetation, erosion
- Increasing disturbance of native flora and fauna, including in 'conservation areas'
- Invasive species of flora and fauna
- Altered hydrology/tidal restrictions, such as river-walls and revetments that cause benthic 'scouring'
- Past decisions, e.g. infrastructure built next to rivers leave little room to improve foreshore environments
- Community expectations that views are to be protected; leads to reduced capacity to restore habitat, increased water temperatures through lack of tree canopy, etc.
- Poor and dominating architecture and shoreline retention engineering (Belmont)
- Impact of huge number of dogs on the foreshores
- There have been too many engineered rock walls installed to protect river foreshores
- Kwinana Freeway along South Perth foreshore - environmental and visual blight



Other impacts on biodiversity

- Loss of aquatic plant habitats
- Loss of prawn and cobbler fisheries
- Constant disturbance of shorebirds
- Dolphins killed by fishing line entanglement and powerboats
- Diminishing numbers of native fauna and areas of native flora - more listed as 'threatened'
- Declining species number and health - dolphins, sharks, prawns, birds etc.
- Along with contaminants, morbillivirus coming back every 10 years and affecting ~5 dolphins within a year
- Harmful algal blooms, e.g. *Alexandrium*
- Lack of hard substrate

Water quality

- Probably less winter flushing of the system and too much nutrient input
- Less people swimming in the Estuary
- More notification of the health risk in consuming crabs for example suggests the estuary is in poor health
- Algal blooms in the summer. Deoxygenation in some locations
- Decline in water quality
- Regular algal blooms, low dissolved oxygen (DO) levels, fish kills
- Contamination, pollution and litter
- Continuing fish kills and algal blooms, little improvement in water quality and river health despite a growing public awareness of the Swan's history and importance

Recreation

- Too many boat moorings
- Increasing expectations/demands: recreational usage, poor planning decisions, development & infrastructure
- Jet skis and motorboat numbers and in previously excluded areas
- Over investment in fishing facilities to satisfy lobbyists
- Loss of jetties

Climate change impacts

- Increased sea surface temperatures and sea level rise as a direct result of climate change, reduced streamflow and reduced water quality
- (Other threats) exacerbated by climate change

Funding for management

- Reductions in research funding



Q3 The Swan-Canning Estuary is managed for a variety of ecological, socio-economic and cultural values. What is it about the estuary that is MOST IMPORTANT to you? Name up to 5. This could, for example, include things like fish, waterbirds, water quality, recreational experiences, access, specific places, sense of place etc.

Ecological

- The ecological health of the estuary - reflected in and dependent on its biodiversity - underpins other values. Without its ecological health it has no other value
- Place of refuge and respite for many species - diversity and opportunities for interactions
- Ecological values; functional ecosystem; ecosystem services
- Sustainable use and access to the marine and estuarine flora and fauna of the Swan Canning River system. This is underpinned by healthy nursery habitats, balanced trophic interactions, water quality, effective resource management etc.
- Foreshore vegetation and wildlife
- Migratory waterbirds
- An ecological corridor
- Reserve for local native vegetation particularly remnant vegetation, e.g. Andrew Thomson Reserve, Canning River Regional Park
- Waterbirds
- Seagrass
- Waterbirds
- Fauna protection (by protecting/providing habitat, controlling feral species)
- Water quality; clear water; presence of prawns and dolphins in the river
- Whole of catchment approach to the river and estuary

Cultural

- Noongar use of the Estuary
- Cultural recognition to educate the public
- Aboriginal Heritage place nodes/sense of place
- Aboriginal history
- Protection of cultural values
- Noongar dreaming/creation stories that explain the landscape of the coastal plain

Social amenity

- Amenity/vistas; access to viewing points to appreciate the views
- Sense of place
- Aesthetics
- Connected public space that is much used, particularly for important events in the lives of Perth residents
- How the estuary allows thinking with water in Perth - water flows through the landscape and in and out of the ocean, including through us. This is a different kind of connection.
- An identity for Perth

Recreational opportunities

- Recreational (but need more shade trees fringing the estuary)
- More people swimming in the stuary (many people probably concerned about water quality)
- People able to participate in contact water spots in the Canning and Swan River
- Passive and active (cycling and running) recreation
- Recreational opportunities that don't impact river environments; Recreation on the river, particularly by groups like water scouts, that deeply connect and enable water skills like sailing, fishing, swimming
- Tours along the Swan showcasing the natural features
- Recreational experiences underpinned by healthy abundant fish/crab stocks

Q4 In 10 years' time, what SPECIFIC CHANGES would you like to see in the Swan-Canning Estuary? These might include changes such as the condition or abundance of biodiversity, management, community usage and behaviour, management of specific places or features, etc.

Foreshore habitats

- More of the bank of the estuary rehabilitated with native vegetation
- Areas of restricted access to preserve ecological habitat/biodiversity, but perhaps with walking/bike trails passing through
- Major increases in local native vegetation cover of the foreshores including more trees
- Increase in extent of available habitat
- Foreshore trees to increase biodiversity and improve user amenity
- Ensure the protection of ALL ecosystems including salt marches and swamp lands
- Improved erosion control and increasing riparian vegetation
- Curtailed or reduced impact of engineered structures
- An increase in the breadth of fringing vegetation and its diversity
- Better protection and investment in sensitive areas e.g. Threatened Ecological Communities

Biodiversity

- Increased biodiversity
- Healthy dolphin population in the Swan
- Good seagrass beds through the Swan
- Protected sanctuary for wading birds from cats and dogs
- Increased extent of seagrass
- More habitat, snags, shellfish reefs, complex habitat on walls

Water quality

- Reduced input of nutrients from the catchments
- No need to have oxygenation plants on the Swan or Canning system
- Water quality improvement
- Reduced frequency and severity of algal blooms and fish kills
- Improvements to drainage assets

Recreation

- Continued access for people and water sports
- More recreational opportunities, especially for swimming and paddle sports (stand up paddle boards, kayaks/canoes, water bikes, floating* cinemas, floating* dining/drinks (*floating as in people sitting on tube rings for events during the warmer months, not necessarily barge restaurants/venues)
- Walking and cycle trails that link up through Local Government Area and State agency lands, including paths on both sides of road bridges that link them
- Ensure facilities for sport and recreation are provided in addition to regional/foreshore reserves

Recreational fishing

- Healthy recreational fisheries for Black bream, prawns, crabs
- From a purely resource access, allocation and sustainability perspective, the level of participation and extraction of the marine/estuarine resources needs to be better quantified and managed. Particularly when considering the population of WA is increasing, the demand on the Swan Canning resources (fish species, crustaceans, molluscs etc) will in turn increase
- Fisheries management incorporating social objectives
- Fishers embraced and defended as an important user group

Behaviours, attitudes

- More areas effectively protected from human disturbance and resource exploitation
- More respectful attitudes by residents and visitors to the natural environment resulting in reduction in, for example, vegetation vandalism, trampling of vegetation, disturbance of waterbirds particularly by off-leash dogs, fishing line not being discarded in the river.
- Strict management and governance of 'tourism attractions'

Noongar culture

- More acknowledgement of Aboriginal culture, specific to a place/location, not just the Swan/Canning Rivers (as a whole)
- Increased awareness of Nyungar values of the system
- Management that more actively involves First Nations Australians

Planning, management

- Better conservation measures from land adjacent to key river usage spots (e.g. better waste management)
- Planning for the impact of climate change
- Greatly increased resourcing for estuary managers, particularly DBCA but also local government. We need a well-resourced organisation with sole responsibility for management of the estuary to be reinstated
- Greater recognition of its value/place in Perth's heritage and a corresponding priority allocation of resources to its on-going care and management. Perhaps a return to /review of the 'Priority Plan' for investment in the Swan Canning Catchment developed by 22 local governments in May 2011 and proposal for a levy on rates.
- A landscape-focused management plan with a clear vision to manage the cultural and ecological values in order to generate socio-economic values. The Swan-Canning Estuary is a largely unrealised resource that has the potential to shift how Perth residents engage with the environment of the Swan Coastal Plain.
- No commercial fishing
- Ensure the view from the river of the natural foreshore is maintained and not broken with structures and buildings
- An aquarium dedicated to showing the public the marine and estuarine species using the Estuary. This will help the public understand why it is important to invest in maintaining the health of the system. The aquarium should be built adjacent to the estuary.

Q5 Looking ahead 20 years, what gives you the most OPTIMISM for the future of the Swan-Canning Estuary?

Understanding, awareness

- Growing shift in cultural awareness and recognition of the intrinsic value of the natural environment and Aboriginal connection to Country
- Increased patronage and concern for the river, a much greater appreciation of the extraordinary natural values of the estuary in the middle of a large city
- Increased knowledge leading to better practices and outcomes
- Increased community awareness and ownership of river environments generating behaviour change
- The increasing understanding among people in the community about the importance of natural areas to their own physical and mental health
- Recognition by local government of the need to improve natural vegetation cover of the foreshores

Resilience of the system

- Despite all the adverse things that have impacted on the estuary since the arrival of European settlement, it has shown considerable resilience
- Continued large numbers and diversity of birdlife seen around the estuary
- The work and investment occurring now may assist in making the environment more resilient for the future



Q6 Looking ahead 20 years, what gives you the most cause for CONCERN for the future of the Swan-Canning Estuary?

Climate change

- Climate change apathy, reducing the impact of groups like TNC
- Drying/warming climate with greatly reduced freshwater flows with more algal blooms, fish kills
- Climate change impacts, including reduced freshwater inputs and altered water quality regimes due to extreme events
- The Swan Canning system is vulnerable to climate change. The ecological profile of this unique interface will be forever altered if climate change is not arrested now. The floral and faunal composition will change and the Swan Canning system we see today will not exist in 20 years
- The continued impacts of climate change
- Erosion and inundation from climate change not factored into management and resource allocation
- Declining river flows
- How the impacts of climate change and rising sea levels will be managed
- Increased pollution and nutrients inflow coupled with climate change and population pressures will place ever increasing strain on the system. Budget constraints from relevant stakeholders mean the funds aren't available to deal with these issues.

Population pressures

- Greatly increased population pressures on the rivers and river foreshores
- Popular demands for recreational developments which have an adverse impact on the estuary environment
- Population increase within the catchment and associated urban and industrial development
- Current ineffective management and the growing population
- Increased pollution and nutrients inflow coupled with climate change and population pressures will place ever increasing strain on the system. Budget constraints from relevant stakeholders mean the funds aren't available to deal with these issues.
- The increasing pressures as the population increases
- Over-development
- Some members of the community who think they can do as they please and access the river/shore inappropriately causing habitat degradation and bank erosion, as well as the growing population putting recreational pressures on riverine areas.

Water quality

- Less flushing during winter and declining water quality
- Continued frequency of algal blooms and deoxygenation events
- Pollution from historic landfill and tanneries, moving through the groundwater towards the Swan River.
- Lack of monitoring and control of drainage systems
- Increased frequency of Alexandrium outbreaks
- Increased pollution and nutrients inflow coupled with climate change and population pressures will place ever increasing strain on the system. Budget constraints from relevant stakeholders mean the funds aren't available to deal with these issues.

Planning, Management, Resourcing

- Resourcing levels for management authorities
- The failure to articulate a clear and driving vision and overarching framework for achieving this vision.
- Inappropriate development.
- The scale of the interventions are not meeting the scale of the issues and very little restoration and amelioration work is occurring further out in the catchments (particularly the Avon basin)
- The lack of 'space' for healthy habitats to coexist in urban environments

Q7 If you had \$10,000 TO INVEST in actions to support the changes you want to see in the estuary, what would you do?

Direct protection and restoration of biodiversity, habitat

- Manage areas to protect wildlife
- Weed control and revegetation of degraded sections
- Planting and watering for the initial 2-3 years of local native trees, e.g. Eucalyptus rudis (Flooded Gum) and Eucalyptus gomphocephala (Tuart) along bare sections of the foreshore
- Explore artificial reefs as a means improving fish life
- Community-based fringing habitat restoration, particularly in and around drainage system entry points
- Install snags and complex habitat

Planning, management

- Scope a project to develop a comprehensive landscape-level plan for the Swan-Canning Estuary

Communication, awareness

- PR campaigns aimed at reducing the adverse impact of recreational fishing in the estuary
- Marketing or communication plan on health
- Promote the Swan River Dolphin as the river mascot to raise awareness

Q8 If you had \$100,000 TO INVEST in actions to support the changes you want to see in the estuary, what would you do?

Direct protection and restoration of biodiversity, habitats

- Major revegetation of selected sections of the foreshore that were degraded or relatively devoid of vegetation
- Community-based fringing habitat restoration, particularly in and around drainage system entry points
- Habitat protection
- \$70K erosion control; \$10K weed control; \$10K planting native sedges; \$5K access management; \$5K environmental signage
- Invest in a strategic project to protect a priority area, e.g. saltmarsh threatened ecological communities, involving on-ground action
- Engagement of local groups to deliver direct health outcomes
- A human movement management plan to substantially reduce human disturbance at Pelican Point and implementation commenced, with particular emphasis on protecting the terrestrial area of the Swan Estuary Marine Park. Close the storm water drain that flows directly into the lagoon from the Scout's car park, with storm water in the Scout's facility managed on-site

Threat reduction

- Develop strategies to assist polluters clean up their practices
- Install rubbish surface skimmers to collect plastics, domestic waste etc from entering the waterways
- Co-fund local government and Water Corporation drain pollutant trapping and nutrient stripping retrofits
- Research & Development into how the effects of sea level rise are going to be managed/mitigated

Planning, management

- Develop a comprehensive landscape-level plan for the Swan-Canning Estuary with actions and costings including the values it would enhance/generate

Other

- Place a series of sculptures acknowledging Aboriginal Culture
- Enabling (environmentally-sensitive) recreation opportunities
- Build a jetty to increase connection to the river

Q9 If you had \$1,000,000 TO INVEST in actions to support the changes you want to see in the estuary, what would you do?

Direct protection and restoration of biodiversity, habitats

- Manage areas to protect wildlife
- Fringing habitat creation
- Enhance seagrass resilience through genetic future-proofing (i.e. identify genotypes likely to be most resilient to future water quality regimes and distribute these through the system).
- Habitat protection
- \$900K erosion control; \$40K weed control; \$40K planting native sedges; \$10K access management; \$10K environmental signage
- Installation of vegetative foreshore protection
- Invest in a range of strategic projects to improve water quality and biodiversity, reduce threats and increase resilience of remnants

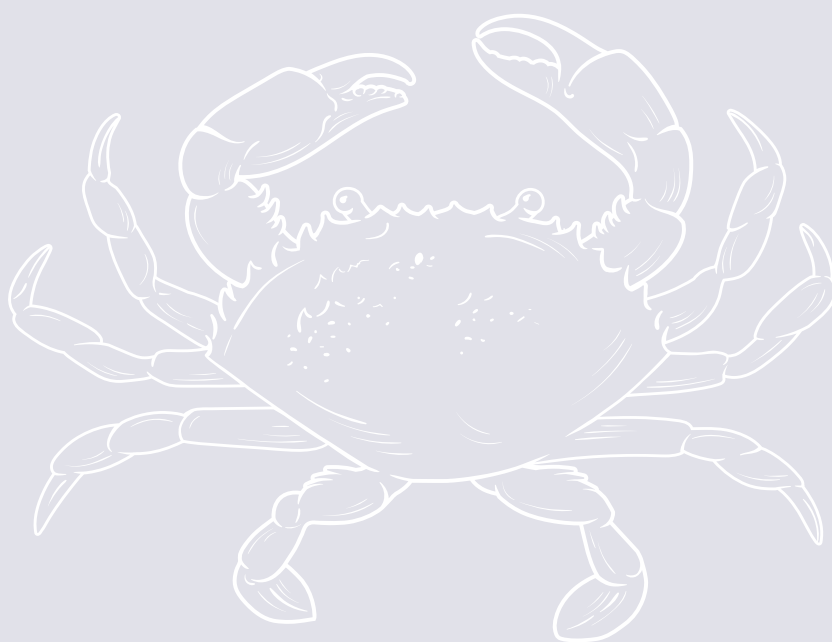
Threat reduction

- Erosion control around older River nodes like Belmont, Maylands, Bayswater, Bassendean and Guildford that accommodates increased access to and recreational use of the river.
- Commence substantial, well-researched, scientifically based erosion-mitigation efforts for Pelican Point.

- Upper catchment nutrient reduction
- Drainage system management action to improve water quality; Co-fund local government and Water Corporation drain pollutant trapping and nutrient stripping retrofits and promote their value to the community
- Implement strategies to assist polluters in adopting cleaner practices
- Employ personnel to service surface skimmers and identify types of trash and source
- Develop educational materials to encourage behavioural change - prevent rubbish from entering the system in the first place
- Conduct annual waste and water quality audit over 3 years
- Invest in climate change adaptation

Management, planning

- Extra on-ground staff for DBCA and relevant local governments specifically tasked with environmental management of the estuary
- Implement the (comprehensive landscape-level) plan for a two year period to demonstrate the benefits for Perth's residents, other species, and economy
- Buy out the commercial fisherman
- Build the aquarium mentioned in Item #4



About TNC

Our **mission** is to conserve the land and waters on which all life depends. Our **vision** is a world where the diversity of life thrives, and people act to conserve nature for its own sake and its ability to fulfill our needs and enrich our lives.

The Nature Conservancy (TNC) was founded in 1951 and now works in 76 countries with a staff of nearly 4,000 people, including 400 scientists. The Australia program was formed in 2002, collaborating with local communities, governments, Indigenous groups, businesses and other conservation agencies. TNC Australia has supported conservation efforts across more than 126 million hectares. Our focus is to address the most pressing conservation threats at the largest scale through our scientific and collaborative approach.

How do we achieve our mission and vision?

- Through our dedicated and diverse staff
- With the help of our many partners, from individuals and governments to local non-profits and corporations
- Through staying true to our core values: Integrity beyond reproach; Respect for people, communities and cultures; Commitment to diversity; One Conservancy; and Tangible, lasting results
- By using a non-confrontational, collaborative approach

Our mission

TO CONSERVE THE LANDS AND WATERS ON WHICH ALL LIFE DEPENDS



ESTABLISHED IN

1951



Largest

CONSERVATION NON-PROFIT IN THE WORLD



76

COUNTRIES



6

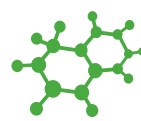
CONTINENTS

Our people



4,000

STAFF MEMBERS



400

SCIENTISTS

**Thankyou for supporting
The Nature Conservancy.**

Contact

Andrew Bossie
Oceans Project Coordinator,
Swan-Canning Estuary
andrew.bossie@tnc.org

T: (+61) 421 756 271

www.natureaustralia.org.au

The Nature
Conservancy 
Australia