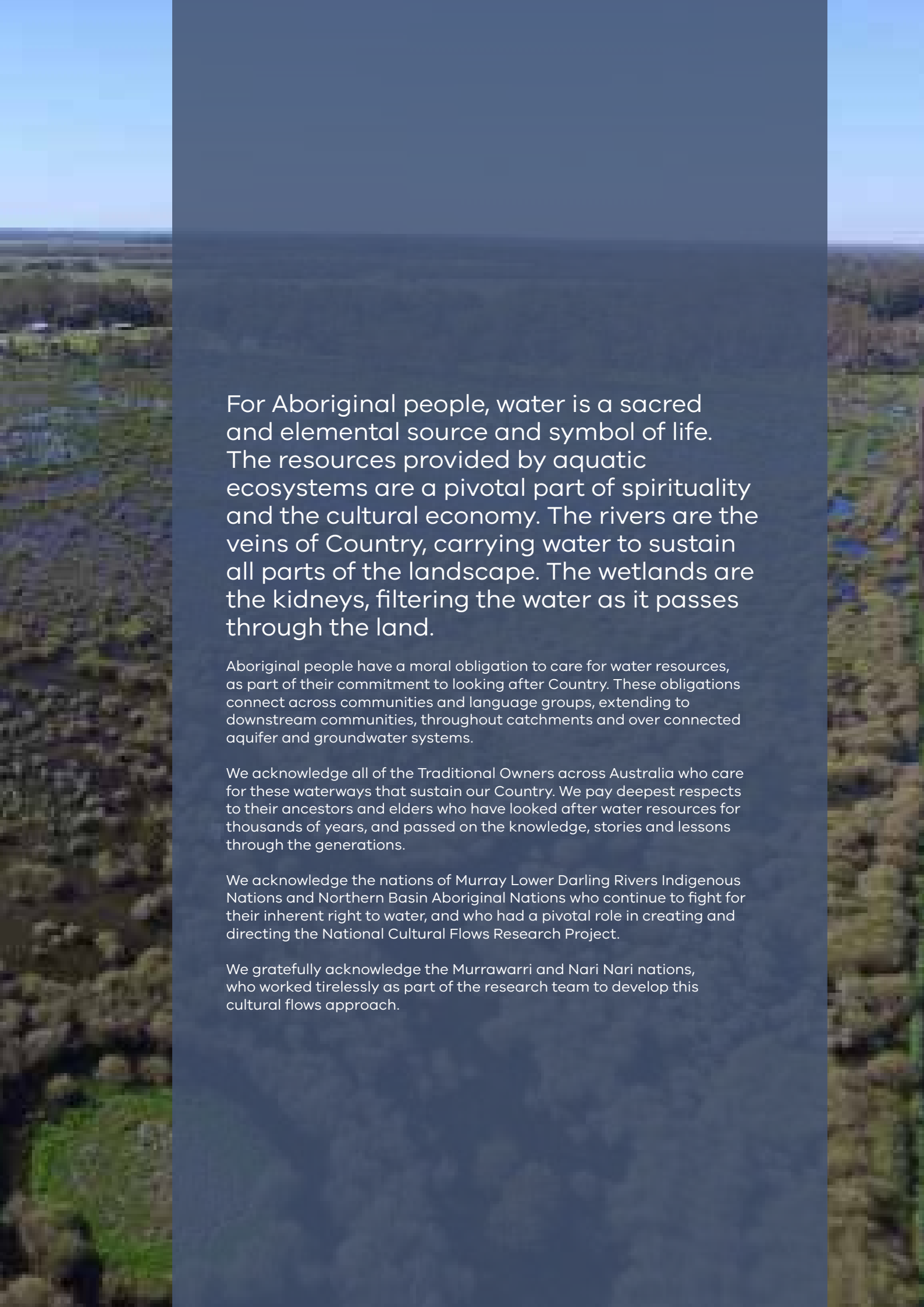
CULTURAL FLOWS

A GUIDE FOR WATER MANAGERS

NATIONAL CULTURAL FLOWS RESEARCH PROJECT



For Aboriginal people, water is a sacred and elemental source and symbol of life. The resources provided by aquatic ecosystems are a pivotal part of spirituality and the cultural economy. The rivers are the veins of Country, carrying water to sustain all parts of the landscape. The wetlands are the kidneys, filtering the water as it passes through the land.

Aboriginal people have a moral obligation to care for water resources, as part of their commitment to looking after Country. These obligations connect across communities and language groups, extending to downstream communities, throughout catchments and over connected aquifer and groundwater systems.

We acknowledge all of the Traditional Owners across Australia who care for these waterways that sustain our Country. We pay deepest respects to their ancestors and elders who have looked after water resources for thousands of years, and passed on the knowledge, stories and lessons through the generations.

We acknowledge the nations of Murray Lower Darling Rivers Indigenous Nations and Northern Basin Aboriginal Nations who continue to fight for their inherent right to water, and who had a pivotal role in creating and directing the National Cultural Flows Research Project.

We gratefully acknowledge the Murrawarri and Nari Nari nations, who worked tirelessly as part of the research team to develop this cultural flows approach.

This guide has been prepared by the Cultural Flows Planning and Research Committee as part of the National Cultural Flows Research Project, developed by and for Aboriginal nations with the aim of helping to embed Aboriginal water allocations in Australia's water management framework. Funding for the Research Project has been generously provided by the Murray Darling Basin Authority, the Commonwealth Environmental Water Office, the National Water Commission, and the Department of Families, Housing, Community Services and Indigenous Affairs. Original report authored by Dr John Mackenzie, Dr Rhonda Butcher, Dr Chris Gippel, Peter Cottingham, Rowena Brown, Klynton Wanganeen, Thomas Kloeden and Tamarind Meara.

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Overview

The National Cultural Flows Research Project was a collaborative research effort driven by and for Aboriginal people. It was established to provide rigorous and defendable knowledge on Aboriginal water interests, with the aim of securing a future where Aboriginal water allocations are embedded within Australia's water planning and management regimes, delivering cultural, spiritual, social, environmental and economic benefit to communities in the Murray-Darling Basin and beyond.

Over three years, a team of technical experts worked in collaboration with representatives from the Nari Nari and Murrawarri Nations to develop and implement methods to describe and measure Aboriginal current and aspirational water uses and values, in terms of specific water volumes. Using established ecological, remote sensing and socio-cultural monitoring techniques, the researchers were able to demonstrate the cultural, ecological, social, and wellbeing outcomes of participation in a cultural flow planning process.

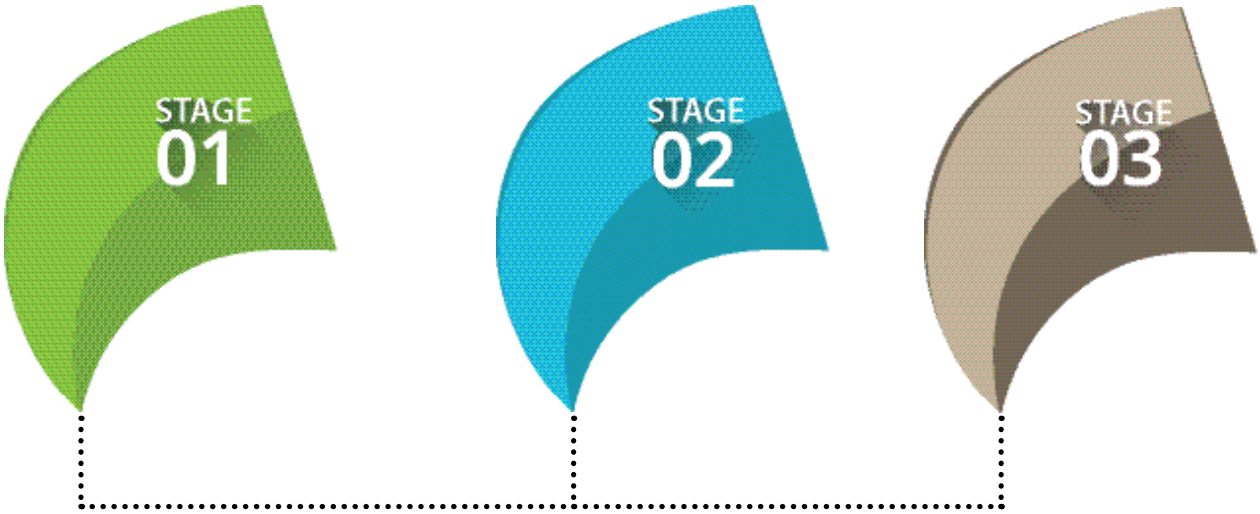
This *Cultural Flows: Guide for Water Managers* (the Guide) was developed based on the lessons learnt throughout the research project. It is intended to be of use to Aboriginal Nations wishing to undertake watering for cultural outcomes, and provides an accessible and flexible process for the inclusion of cultural flows within existing water planning and management regulations.

It is important to note that policies relating to cultural flow allocations are still being investigated. The Guide provides for a community-led process to determine how to decide what to do with a cultural flow (if and when a cultural flow is available).

The Guide outlines a staged, 10 step process for establishing objectives for cultural water in relation to a Nation's needs and goals for a particular place. It includes a process for identifying cultural values and objectives, estimating the volume and timing of water required to support the values, preparing a Cultural Flow Management Plan and associated monitoring program, and finally implementing the assessment and reporting on the outcomes of the cultural watering (Figure 1).

This *Guide for Water Managers* is targeted towards people with a technical background in water management, and provides detailed instructions for undertaking a cultural flow assessment. A summary version *Cultural Flows: A Guide for Community* is also available. Technical resources and templates can be found at www.culturalflows.com.au.

CULTURAL FLOWS



STAGE 1

IDENTIFY CULTURAL VALUES AND SET CULTURAL FLOW OBJECTIVES

Establish relationship with water planning and delivery agencies

STAGE 2

DEVELOP A CULTURAL FLOW MANAGEMENT PLAN

Secure and deliver water

STAGE 3

IMPLEMENT MONITORING, EVALUATION AND REVIEW OF CULTURAL OUTCOMES

Build capacity and adaptively manage cultural water

FIGURE 1 Overview of the Cultural Flows Stages

Table of Contents

THE GUIDE

INTRODUCTION

BACKGROUND

Aboriginal organisations around Australia are seeking to adapt water laws to provide water for the benefit of Aboriginal people. One of the important ways this can be achieved is for Aboriginal Nations to obtain and use their own share of the water resource to provide spiritual, cultural, environmental, social and economic benefits to the people of those Nations. This kind of water is referred to as a "cultural flow", defined as:

> *..."water entitlements that are legally and beneficially owned by the Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Nations. This is our inherent right."*
>
> Echuca Declaration, 2010

Making sure that every Aboriginal Nation around the country has access to cultural flows is an important step in achieving water rights for Aboriginal people, as is the right of Aboriginal people to participate in the process of making cultural flows available.

AUDIENCE FOR THE GUIDE

Developed as a tool to assist Aboriginal Nations to conduct decision making processes for planning, management and assessment of a cultural flow, this *Cultural Flows: Guide for Water Managers* (the Guide) has been written primarily for Aboriginal Nations and communities, and any additional technical experts they engage to participate in their cultural flow assessment. The Guide may also be useful for State and Commonwealth water planners and specialist academic researchers.

APPLYING THE GUIDE – KEY PRINCIPLES

The Guide was developed by, for and with Aboriginal people by applying ethical research approaches and engagement practises (e.g. AIATSIS 2012, NCFRP 2016a and b, NCFRP 2017a). The three core principles for applying this Guide include:

1. Planning and research must meet the needs of the Aboriginal organisations;
2. Research and planning is implemented with free prior and informed consent of Aboriginal participants; and
3. At all stages has regard for Aboriginal decision-making processes.

ENGAGING EXPERTISE

Aboriginal Nations across Australia will have varying levels of expertise available to support implementation of the Guide. The characteristics of the chosen watering place and the objectives for cultural water management will also influence the range of skills and expertise required. In undertaking cultural flow management it is recommended that an oversight or coordination body is appointed to direct and coordinate application of the Guide, and is supported by a dedicated project manager to coordinate the work flow on a day to day basis. The project manager may or may not be the key liaison with the community knowledge holders, who will also need to be identified.

Aboriginal Nations will need to lead the process and ensure local capacity is engaged for meaningful outcomes. Where local capacity or data is limited, additional expertise can be brought in to help fill critical knowledge gaps and at the same time, create opportunities to build capacity of all participants throughout each stage. Depending on the agreed aspirations, values and objectives, other specialist expertise may be required and will need to be identified by the oversight group.

Some of the expertise that may be required for implementation of the Guide could include one or more of the following:

- Traditional Aboriginal Knowledge.
- Community liaison and facilitation.
- Project management.
- Natural resource management or water planning.
- Aquatic ecology generalist.
- Botany and zoology.
- Hydrology.
- GIS and mapping.
- Data management and storage.
- Cultural heritage (archaeology/ anthropology).
- Business planning/management.

Aboriginal Nations may like to consider how they participate in the project and can benefit, for example, through the involvement of children, youth, women and/or the elderly in your project. This may lead to opportunities to enhance the transfer of Traditional Aboriginal Knowledge between and across generations whilst the planning, research and monitoring takes place.

SUPPORTING RESOURCES

To help implement the Guide, supporting resources are supplied for additional information – available at www.culturalflows.com.au

It is important to note that these supporting resources are not exhaustive and they may not be suited to all Nations, geographic locations or watering place-specific contexts. There may also be different recording standards that are used in different jurisdictions. Users are encouraged to use recording systems that reflect relevant standards and can meet their individual needs.

KEY TERMS AND DEFINITIONS

For the purpose of the Guide the following terms and definitions have been adopted:

Authorised Knowledge Holder

A person, normally a Traditional Owner, who has been provided cultural and/or traditional knowledge of a particular place or thing through customary law and is recognised by the Traditional Owner community to have the authority to speak on or share that particular knowledge where appropriate.

Cultural Flows

"Water entitlements that are legally and beneficially owned by Aboriginal Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right" (MLDRIN 2007, p. 2).

Cultural Flow Management

Cultural flow management requires the establishment of relationships between Aboriginal Nations and a range of organisations including waterway managers (e.g. Catchment Management Authorities, Natural Resource Management groups and Boards), storage managers (water corporations), local land managers and technical experts. Cultural flow management incorporates the identification of eligible watering places, prioritising which places receive water, overseeing the delivery of cultural water, and reporting on the outcomes (adapted from VEWH, 2015).

Traditional Aboriginal Knowledge (TAK)

TAK includes the cultural traditions, values, beliefs, and worldviews of Aboriginal peoples as distinguished from Western scientific knowledge. Traditional Knowledge is based on direct experience, testing, observation of patterns over long periods of time, and teachings and recording in the collective memory through oral tradition, storytelling, ceremonies and songs. It is a holistic and inclusive form of knowledge (adapted from Dei 1993, p.105; Augustine n.d.).

Watering place

The physical location (site) to receive the cultural flow within Country. Within the context of this Guide, the watering place is a specific location within Country which has connections to, and importance for, contributing to water related cultural values. It may be a single aquatic ecosystem or a complex of ecosystems and or locations, noting that Nations do not partition Country in the same way as Western Science.

Western Science

The systematic study of the nature and behaviour of the material and physical universe originating in European enlightenment. This system of knowledge is based on repeated observation, experiment, and measurement, and the formulation of laws to describe these facts in general terms

A full list of terms and definitions is provided at the end of this Guide.

ABORIGINAL CULTURAL AND SPIRITUAL CONNECTIONS WITH WATER

A key concept contained within the definition of a cultural flow relates to Aboriginal cultural and spiritual connections with water. The inextricable connectivity between identity, spirituality and water gives Aboriginal people a unique role in water resource management. Aboriginal identity and the status of traditional ownership and custodianship should be recognised and reinforced throughout water management.

Recognition and respect of customary governance arrangements, including the cultural and spiritual dimensions of those arrangements, are vital to effective Aboriginal water management. To facilitate this, Indigenous culture and values must be identified and incorporated in natural resource planning and implementation, particularly with respect to the distinct connections maintained by Aboriginal people to those resources. Of these connections, it is the spiritual and cultural connections between water, and sacred places, animals and plants that depend on water that is the most under-accounted in current water governance.

For Aboriginal Australia, water is a sacred and elemental source and symbol of life (Langton 2006 cited in Jackson 2006), with the resources provided by aquatic ecosystems a pivotal part of spirituality and cultural economy (Weir *et al.* 2013). Australian Aboriginal communities have a moral imperative to care for surface and groundwater resources, as part of their commitment to looking after Country (Yu 2000; Goode 2003 cited in Syme *et al.* 2008) as evidenced by dreamtime stories and cultural and spiritual activities (Syme *et al.* 2008). These obligations connect across communities and language groups, extending to downstream communities, throughout catchments and over connected aquifer and groundwater systems. For water governance to meet the needs of Aboriginal people, it must capture the spiritual connection as well as the cultural responsibilities derived from these obligations.

The spiritual aspects of the relationship between Aboriginal people and water was reiterated by participants throughout the project. For example, the cultural significance of the watering place for the Murrawarri Nation was chosen specifically due to the presence of *Mundaguddah*, the name that the Murrawarri give to the Rainbow Serpent. Murrawarri hydrological knowledge is connected to the *Mundaguddah*, and derives a spiritual dimension from this connection. The *Mundaguddah* travels across Murrawarri Country through the subterranean channels, thereby linking together a series of significant water places through Murrawarri Country and throughout the Murray-Darling system. In particular, the presence and movement of the *Mundaguddah* relies on sufficient quantities of water present at three key places: at an important waterhole in the Culgoa River, the Gerrara Springs and Gooraman Swamp. Each of these places has associated cultural practices, obligations and established cultural prohibitions linked to water availability, and the Murrawarri research team noted that all three water sites have been varyingly impacted by upstream development. Similarly, the aspirations for the use of cultural water in the management of the Toogimbie watering place by the Nari Nari reflected the importance of ongoing protection and preservation of Nari Nari significant sites. These sites, including artefact, burial sites and occupation sites, were not only significant due to their heritage values, but also due to the continuing spiritual presence of ancestors in the landscape. The plant and animal species targeted via cultural flow water are species that have totemic significance to the Nari Nari.

Once aquatic ecosystems are altered, degraded or lost from within a landscape, the particular cultural values associated with that system can be also be permanently lost. Changed conditions of surface and groundwater systems due to historical water development has impacted on both environmental values instream and for the riparian ecology, and this has had a well-recognised impact on the cultural values of the Aboriginal community generally. What is less well recognised, is that there is also an associated significant loss of spiritual connection and sense of well-being. That is, the current water regime continues to have a negative impact on the spiritual and emotional life of Traditional Owners in the community.

The lack of attention to the decline of spiritual values for Aboriginal people in water management is part of what cultural flows intend to address. Cultural flow planning can give credibility and legitimacy to spiritual values in the landscape connected to the water places, and allow participating Traditional Owners to demonstrate the importance of those cultural values, and have those values recognised in the instruments of water management through a potential future allocation of water.

ABOUT THIS GUIDE

The Guide outlines the steps required by Aboriginal Nations across Australia to plan and prepare for a cultural flow allocation. The Guide is a staged, 10 step process (Figure 2) that has been designed to assist Aboriginal Nations in their decision-making processes, to support planning and engagement activities, and to better allow Aboriginal people to engage in cultural flow management.

The level of expertise required, as well as costs and timing for the implementation of each step is likely to vary between Nations, and will depend on the proposed watering place as well as the level of existing expertise and information each Nation already has on hand. At times, Nations may need to seek resources / funds to secure the additional expertise and or data.

CULTURAL FLOWS ASSESSMENT

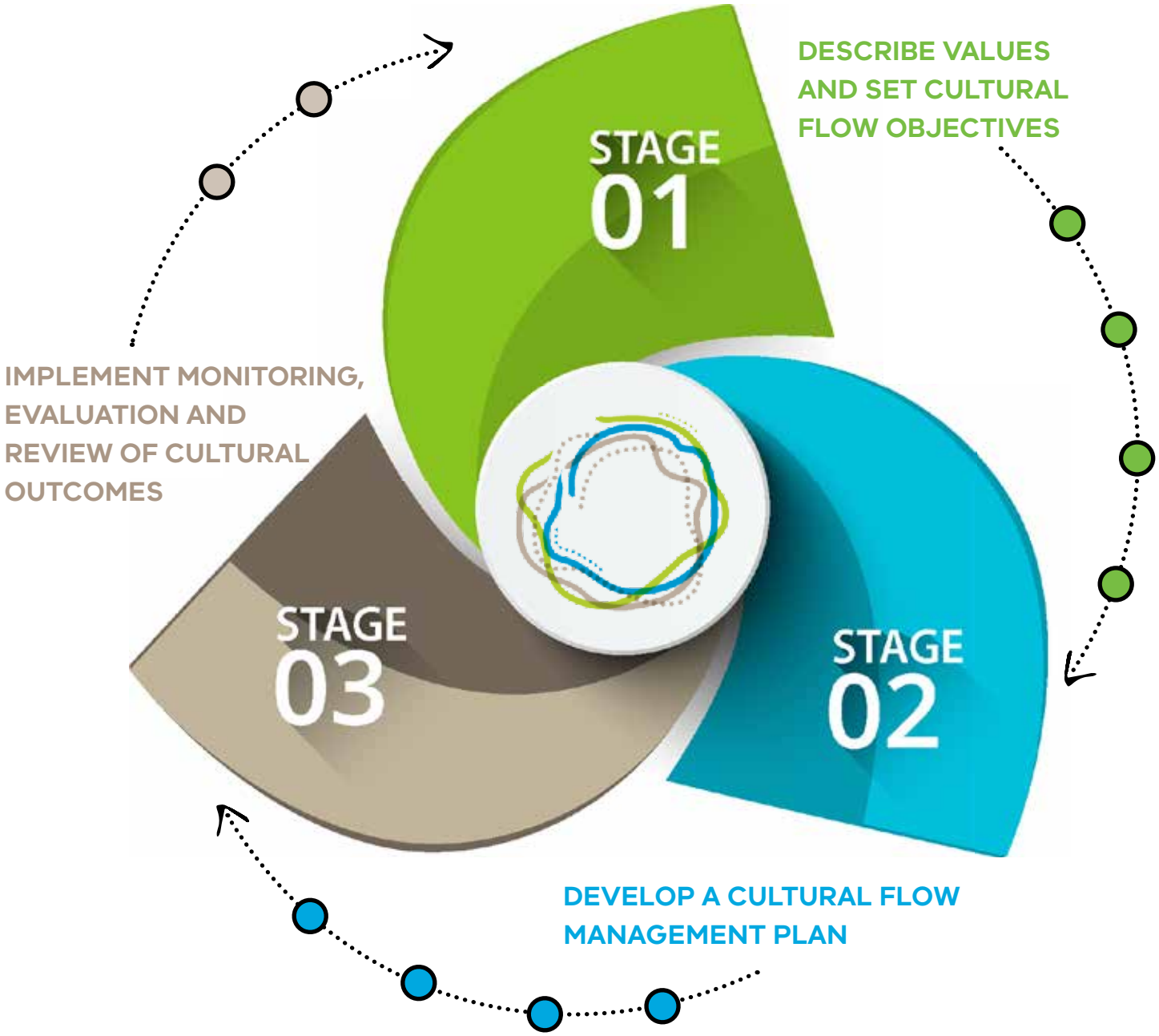


FIGURE 2 Overview of the Cultural Flows Guide

Each step in the Guide is part of an *adaptive management* approach. Adaptive management of cultural flows means managing water in a way where learning from experience and monitoring is used to improve and adapt the management of water resources over time to achieve the desired outcomes. As more information becomes available to communities based on their experience with cultural flows, they will find ways to improve/adjust management priorities (Figure 3).

DESCRIBE VALUES AND SET CULTURAL FLOW OBJECTIVES

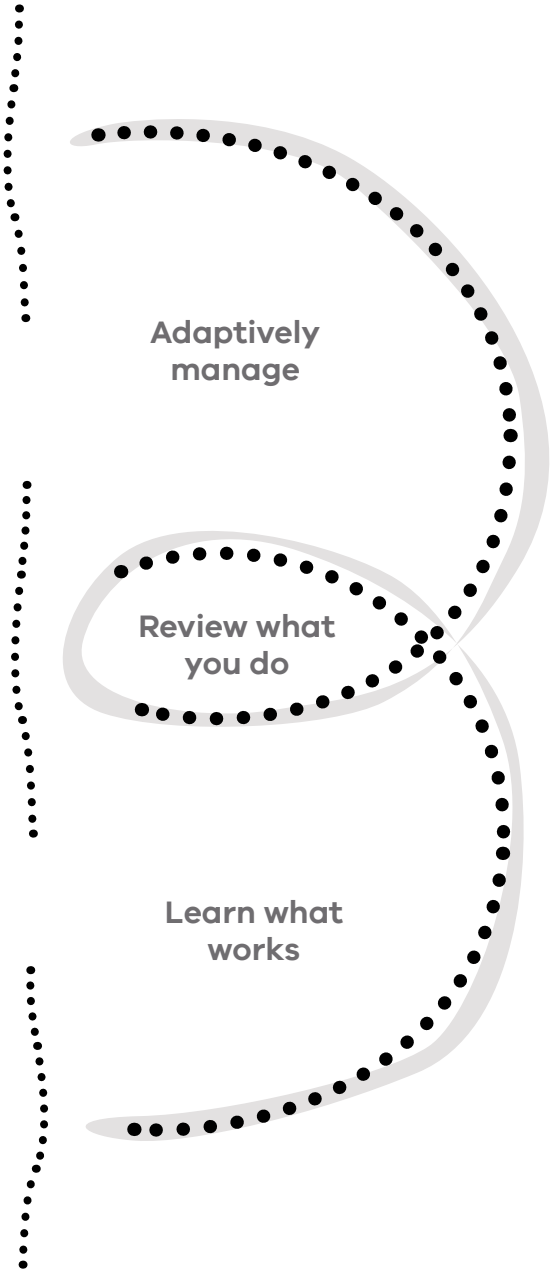
STEP 1 Getting started
STEP 2 Identify values
STEP 3 Build a conceptual model
STEP 4 Set objectives

DEVELOP A CULTURAL FLOW MANAGEMENT PLAN

STEP 5 Summarise the cultural character
STEP 6 Confirm conceptual relationship
STEP 7 Determine water requirements
STEP 8 Prepare A cultural flows management plan

IMPLEMENT MONITORING, EVALUATION AND REVIEW OR OUTCOMES

STEP 9 Select what to measure
STEP 10 Collect and analyse data, evaluate and review outcomes



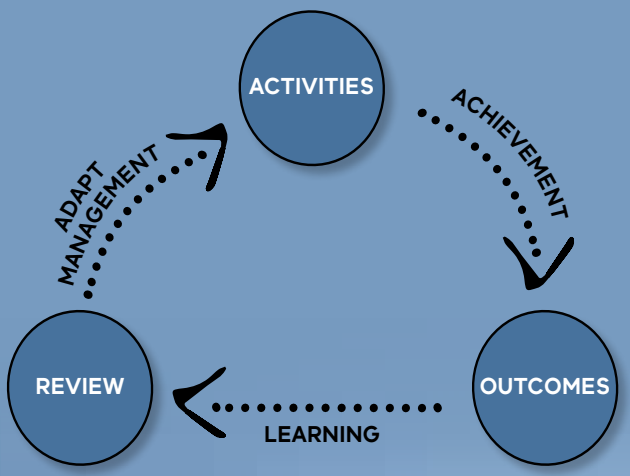
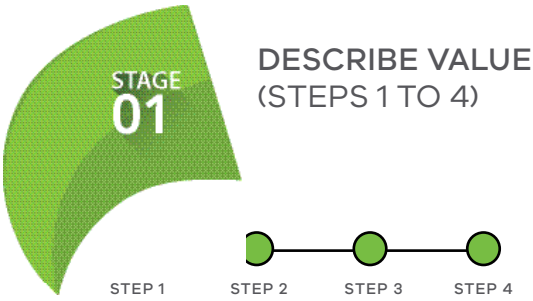


FIGURE 3 Adaptive management cycle



DESCRIBE VALUES AND SET CULTURAL FLOW OBJECTIVES (STEPS 1 TO 4)

The focus of Stage 1 is to identify and prioritise the economic, social and ecological values that are connected to water and captured in the cultural needs and aspirations of Nations. The information is used to set the short, medium and long term objectives and overall vision for the cultural flow management.

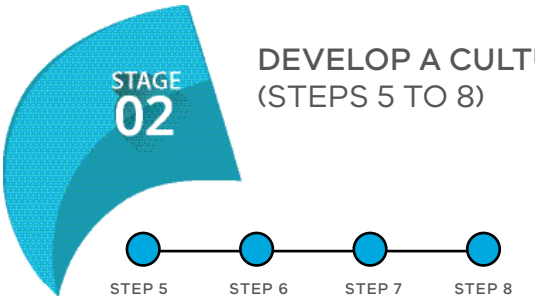
Early in Stage 1, it is advisable to establish an oversight group to coordinate the cultural flow assessment process. This may require identifying key contacts within water agencies to engage in the project, and also seeking out other specialists with expertise in particular fields relevant to the objectives for the cultural flow. This oversight group will:

1. Identify the watering place to receive the cultural flow (Step 1).
2. Develop an agreed approach for working together and gather information about local water stories, historical cultural values, current practices (Step 2 and 3).
3. Coordinate the collation of existing knowledge (Steps 1-4).
4. Develop aspirations and agreed objectives in relation to water (Step 4).

Once the watering place is agreed on and the governance for the oversight body is in place, a data and information gathering step is undertaken. This involves gathering both Western Science data and TAK that will help to describe the cultural, ecological and physical character of the place intended to receive water. All of the information is brought together to build an understanding of the spiritual, cultural, social, economic, ecological, geomorphological (landform) and hydrological values of the place and their interrelationships. Different options are then considered for how best to restore, protect or enhance these values, and how these water management options help to achieve the Nation's aspirations.

Based on the collated information, in consultation with the community, a set of draft objectives are developed. Water scarcity might mean that it is not possible to fully achieve all identified goals, so prioritisation of objectives is important.

The outputs from Stage 1 include the establishment of the oversight group, collation of key information regarding the place to receive the water allocation and a set of draft objectives and outcomes for the intended cultural flow.



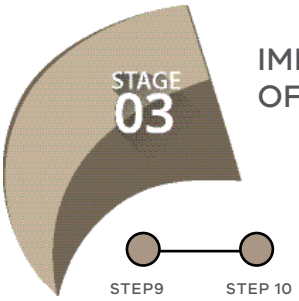
DEVELOP A CULTURAL FLOW MANAGEMENT PLAN (STEPS 5 TO 8)

Stage 2 focuses on the preparation of the Cultural Flow Management Plan (CFMP) for the watering place. The CFMP documents the watering place characteristics (Step 5), confirms the conceptual relationships between water and the stated values of the place (Step 6), and demonstrates an understanding of the watering requirements to achieve stated objectives (Step 7). The key outputs from Stage 1, such as the values of the watering place, objectives and expected outcomes of the cultural flow are consolidated in the CFMP (Step 8). CFMPs may also include the following considerations, each linked to the stated objectives and outcomes expected from a cultural flow:

- The need to make water available for specific uses,
- Putting conditions on how much water can be used and when,
- Using the water to enhance environmental flows, and/or
- Making rules for how water can be traded.

Risks to achieving the desired outcomes, such as drought or flooding, and how these would be managed within the context of the project, should also be addressed in the CFMP. Planners often take a risk-based approach to water management owing to a lack of complete knowledge and uncertainty around future water availability and climate change. If the plan isn't working, or is having unexpected results, it can be modified and will typically include a trigger for updating the plan.

A CFMP should also include provision to monitor the volume of water arriving and used at a place, as part of the water management process. Monitoring of outcomes is covered in Stage 3.



IMPLEMENT MONITORING, EVALUATION AND REVIEW OF OUTCOMES (STEPS 9 TO 10)

The final stage of the Guide focuses on development and implementation of a monitoring plan to assess the effects of the cultural flow (Step 9), collating the results, evaluating the findings and considering whether or not the stated cultural flow objectives have been met (Step 10). Most importantly, it is during this stage that improvements or adjustment for future water management or use will need to be considered.

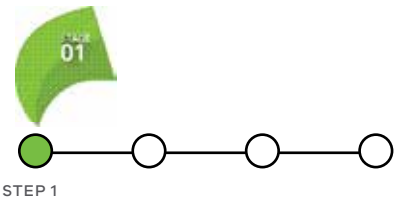
Ongoing monitoring information is used to determine how well the water plan is meeting its objectives. Monitoring design has to be linked to the key components, processes, functions and services stated in the objectives. For example, there is no point in monitoring fish if water is not being delivered to get a fish outcome. Demonstrating and achieving multiple benefits from the water allocated should be included in the planning phase and will strengthen the case for receiving allocations, but ultimately still has to relate to the stated objectives for the cultural flow.

THE GUIDE

STAGE 01

DESCRIBE **CULTURAL VALUES** AND **SET OBJECTIVES**

1 GETTING STARTED



AIM

To identify and collate relevant background information, appoint a Key Nation Contact, and establish an oversight group.

KEY INPUTS AND DEPENDENCIES

- Documented Traditional Aboriginal Knowledge relevant to water dependent aspects of the watering place and Country.
- Existing natural resource management plans relating to the watering place and or Country.
- Existing information on key water dependent species and or communities.
- Existing mapping and GIS layers relevant to the watering place.
- Existing hydrological data and models.
- Readiness, availability and capacity of participants.

ACTIVITIES

1. Identify and engage participants to form a Nation Cultural Flow Working Group (NCFWG)

The NCFWG (or similar group) will have oversight of the project including key inputs into the decision making processes as well as having the ability to speak for or as Country when required. As such the group should include:

- A Key Nation Contact (KNC) to act as the primary point of contact between the Nation and the Working Group, community and water managers;
- Traditional Owners; and
- Authorised knowledge holders nominated by the Traditional Owners.

The membership of the NCFWG should include individuals with cultural, social or ecological interests in the catchment and those who may participate in the assessment of the cultural flow.

Experiences in the NCFRP demonstrated the importance of involving a broad spectrum of the community in the cultural flow planning and monitoring process. This can strengthen the outcomes of the process and the transmission of Traditional Aboriginal Knowledge between and across generations (e.g. how children, youth, elders and women can be involved).
The composition of the working group should be chosen to ensure that the participants in the process include all of the Traditional Owners that speak for the different parts of the selected watering place and its heritage.

2. Agree on the process for seeking Free, Prior and Informed Consent

Initial discussions with the NCFWG should also determine how the cultural knowledge and Intellectual Property identified through this work will be handled and protected. Formal consent forms or agreements based on Free, Prior and Informed Consent should be discussed and considered with all participants.

These discussions should also identify and document the engagement preferences of the members of the NCFWG. Different groups have different protocols for engagement and ways of working together, so these should be clarified during this stage. The outcome from this activity is the acknowledgement of Free, Prior and Informed Consent by all members of the Working Group. This may include an agreed engagement approach, and should be formalised if possible, such as through a Memorandum of Understanding.

3. Identify the place to receive water

The NCFWG will have a key role in selecting the watering place in consultation with the Nation. The process of selecting a watering place can be complex as many places may be worthy of consideration. Some questions that may be useful to guide the selection of a potential watering place, include:

- Which places in the catchment, or on Country, have had their cultural values impacted by changes to water availability?
- Which places are at risk as a result of potential future changes?

- Are there any resources that are important to the Nation for health, wellbeing and livelihood which have been or could be impacted by changes in water availability?
- Are there key locations where members of the Nation have aspirations for future water use, including for commercial purposes?
- Does the place enable the intergenerational transfer of knowledge by practice?
- Is the place important in terms of its connectivity to places of significance, downstream or upstream?

This may also involve considering where the water can be sourced, and how it can be delivered. For example, isolated wetlands may be difficult to deliver water to due to historical changes in river flow. These places may require pumping and other infrastructure, which may make a cultural flow less viable. Provide a succinct justification of why the place has been chosen – this may evolve as objectives and outcomes are specified and agreed on. Further guidance to help select watering places can be found in the Aboriginal Waterway Assessment Program (MDBA 2015).

Once the watering place has been identified, it should be described and mapped so that the boundary of influence of the cultural flow is clearly delineated. This is essential information that will be used to inform how much water will be required to achieve the watering objectives. It is acknowledged that whilst a physical boundary is required to secure an allocation, the outcomes achieved from a cultural flow may extend beyond the watering place.

4. Collate existing information

Source and collate existing documented Traditional Aboriginal Knowledge (TAK) relating to water dependent aspects of the watering place. In addition, source any natural resource management plans or instruments relating to the watering place. This could include recovery plans for threatened species that occur in the area, vegetation mapping and assessment reports, fauna assessments, environmental watering plans and or condition assessments. This process may identify some relevant conceptual models that can be expanded on in Step 3.

5. Identify the need for additional expertise

Identify any areas of expertise held within the NCFWG and the broader community. Where there are gaps, engage experts or other stakeholders to contribute to key steps in the project. Where possible, ensure that capacity building is a key component of the project to support shared understanding, skills and awareness throughout the process.

OUTPUTS

The minimum required outputs from Step 1 include:

- Confirmation of Traditional Owners, Authorised Knowledge Holders, and individuals with cultural, social or ecological expertise.
- The acknowledgement of Free, Prior and Informed Consent. This may include an agreed engagement approach or formalised plan.
- Appointment of a Nation Cultural Flow Working Group and Key Nation Contact.
- Documented responsibilities of the Key Nation Contact.
- Documented composition, responsibilities and governance arrangements of the NCFWG and how it interacts with the Nation.
- Justification for watering place selection and detailed boundary description.
- Mapping relevant to the watering place, including the boundary.

SUPPORTING RESOURCES:

- State Government water and natural resource management agencies will likely have the most accurate and up-to-date information on water resources.
- Regional Catchment Management Authorities (CMAs), Local Land Services (LLS), natural resource management agencies and Boards will have information on conditions, trends and pressures on water and other natural resources in the area.
- The Australian Government hosts the Environmental Resources Information Network (ERIN) as part of the Department of Environment and Energy, which can assist in directing you towards relevant datasets. These datasets include flora and fauna information (such as the SPRAT database, Atlas of Living Australia and the National Vegetation Information System), conservation values, matters of national environmental significance, wetlands, heritage and climate change.
- The Native Title Tribunal website has information on native title determinations, registered claims and Indigenous Land Use Agreements. Native title spatial data can be accessed from Geoscience Australia.
- The Bureau of Meteorology has responsibility for compiling and disseminating comprehensive water information across Australia.

2 IDENTIFY VALUES

AIM

To identify the cultural values for the proposed watering place and the Nation's aspirations and uses for the proposed cultural flow.

KEY INPUTS AND DEPENDENCIES

- Outputs from Step 1.

ACTIVITIES

1. List all the values

Using the expertise of the NCFWG, KNC, Nation representatives and identified experts, scope the full range of the Aboriginal water values and interests connected to the watering place, including the aspirations, uses and values for the water resource. The list will be used to set short, medium and long-term objectives that can be achieved through access to a cultural flow.

Aboriginal water values and interests are diverse. They comprise cultural assets, aspirations and uses of water resources over various timelines, including mythological, traditional, historical, contemporary and aspirational. These interests cover all the ways in which Aboriginal people value and use water resources, how water supports or sustains culturally important places and practices, how it shapes and is shaped by beliefs, and the reliance on that water for the realisation of human well-being, identity, livelihood, quality of life and social cohesion. They include for example, custodial values (such as moral or cultural obligations for the care of the landscape for present and future generations), future use values (including commercial and enterprise development aspirations) and well-being values (such as the qualities of the resource or locations that contribute to physical and mental health, therapeutic activity, well-being and quality of life). Cultural obligations are also important, for example ensuring that Aboriginal groups downstream have continued access to water is an obligation linked to creation, ceremony, song lines, story lines, dance, travel and trade. Figure 4 describes the range of values that should be considered.

The initial list may capture values that are linked to the watering place but may not form the basis of an objective for the actual cultural flow. For example, watering a particular wetland may provide drinking water for terrestrial animals in dry periods, but that may not be the objective for watering.

2. Document the methods used to identify values

Methods for identifying Nation values are well established within social science research and natural resource management practices. General tools such as interviews, focus groups, surveys and data analysis are all relevant and potentially applicable, and there is extensive literature available on the use of these methods.

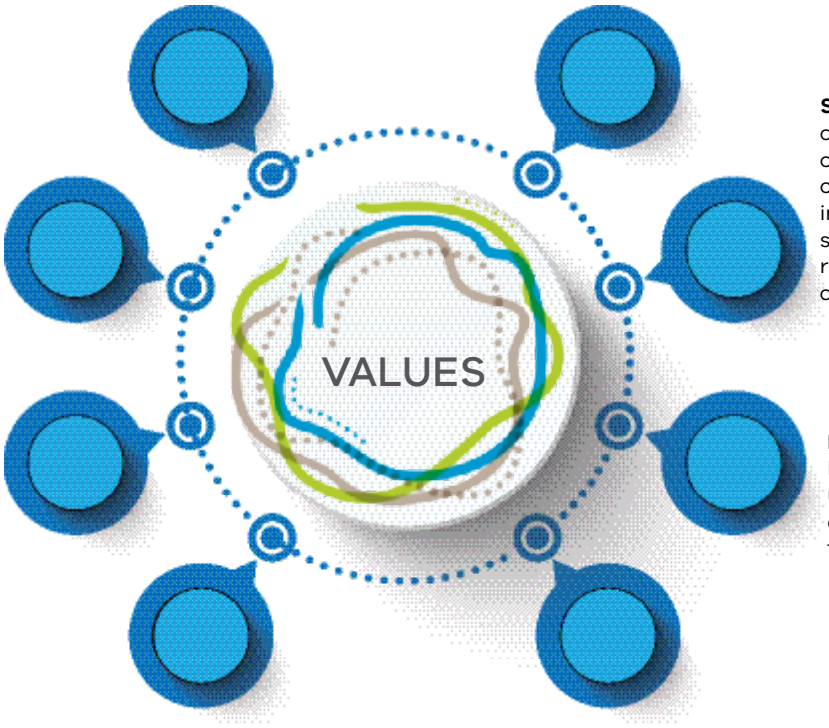
In addition, there are a growing range of tools associated with Aboriginal water management, such as the Aboriginal Waterways Assessments Program developed for use in Aboriginal communities that can assist in eliciting these values. The Aboriginal Waterways Assessments Program has been found to be especially useful for this purpose in providing a consistent methodology for the assessment and documentation of cultural health and management priorities for river systems (MDBA 2015).

The adopted method should be based on the engagement preferences of the NCFWG and Nation representatives, be transparent and consistently applied, and produce findings that are acceptable to the contributors. In setting and agreeing on the aspirations of the Nation the current environmental and social trends, and the drivers of change (economic, land-use, demographic, environmental decline) associated with the place/Country should be taken into consideration.

PRACTICE-BASED: Qualities of the resource or locations that are necessary to support personally, socially or culturally important practices, such as recreational use, resource harvest or religious and ceremonial practices.

FUTURE USE: Including commercial or enterprise development aspirations.

CUSTODIAL VALUES: Moral or cultural obligations for the care of the landscape for present and future generations. Custodial values include values associated with bequest, future options and the transmission of knowledge and learning.



SOCIAL COHESION: Sites or qualities of the resource that contribute to community connectedness, social interaction, trust, inclusion, sense of belonging and the reduction of conflict within a community.

AFFECTIVE VALUES: Qualities of the resource that sustain important affective qualities, such as aesthetic appreciation, ambience, inspiration, sensory responses, ecological appreciation, spiritual realisation and emotional well-being.

PLACE-BASED VALUES: Places that are dependent upon the resource that are significant or valuable for their existence.

IDENTITY VALUES: Sites or features of the resource that contribute to self or group identification.

WELL-BEING VALUES: The qualities of the resource or locations that contribute to physical and mental health, therapeutic activity, well-being and quality of life.

FIGURE 4 Values relevant to the determination of a cultural flow requirement.

In identifying values, the working group might consider the following questions:

- What are the range of benefits that people derive from the resource?
- In what ways do people depend on the resource to meet their needs?
- What places, sites, activities, and relationships in the landscape do people value, and how are these related to water?
- What features of the aquatic ecosystem are those values dependent upon?
- How are these values distributed socially and spatially?
- How do these values differ over time (seasonally, annually, planning horizon)?
- How do these values change at different scales (place-based, catchment, region) and how transferable are values across these scales?
- What is the relationship between the values held by different groups?
- Are they mutually supportive, co-dependent or exclusive?
- How do changes to these values impact on or affect other values?
- How dependant are these values on the current water management regime? If these values and practices are exclusive, what criteria are relevant for assessing which will be prioritised, included or excluded (replaceability, uniqueness, rarity, abundance)?

3. Draft an initial set of aspirations

Aspirations and values need to be described with sufficient detail to determine the specific water requirements or conditions necessary. Values for the cultural flow can include custodial, future use and wellbeing.

OUTPUTS

The minimum required outputs from Step 2 are:

- List of all values and interests relating to water management for the proposed watering place.
- Documented methods adopted to identify the values held by the Nation and any knowledge gaps identified.
- Draft list of the Nations' aspirations for cultural flows.

SUPPORTING RESOURCES

Recommended resources for working with Aboriginal groups to develop natural and cultural resource management plans:

- Walsh, F, & Mitchell, P, 2002, *Planning for Country: Cross Cultural Approaches to Decision-Making on Aboriginal Lands*. Alice Springs: Jukurrpa Books.
- Smyth, D M 2011, *Guidelines for Country-Based Planning*. Cairns: Queensland Department of Environment and Resource Management.
- Example interview protocol is available at www.culturalflows.com.au

Key tools include:

- NSW Office of Water 2012. *Our Water Our Country: An information manual for Aboriginal people and communities about the water reform process*. Edition 2.0. NSW Department of Primary Industries, Office of Water, Sydney, NSW.
- Murray-Darling Basin Authority *Aboriginal Waterways Assessment Program*. Available online at: https://www.mdba.gov.au/publications/mdba-reports/aboriginal-waterways-assessment-program.

3 BUILD A CONCEPTUAL MODEL

AIM

To develop a conceptual model illustrating the full range of water dependent cultural values.

KEY INPUTS AND DEPENDENCIES

- List of values identified in Step 2.
- Any existing models identified in Step 1.

ACTIVITIES

Conceptual models are widely used tools that illustrate the understanding of aquatic ecosystems and the relationships between cultural values and aspects of the environment influenced by water. Conceptual models can take a variety of forms, but are typically presented as a diagram comprised of icons or text boxes that depict the linkages and relationships between the identified values and water (see example in Figure 5). Mind-maps, process diagrams, logic and 'program logic' models, hierarchies, flow charts, tree diagrams and web diagrams are all different ways of graphically representing the information for your conceptual model. Models can include narrative and story-telling, art works, performance, mapping and through language. See supporting resources below for links to guides on conceptual models.

The primary purpose for building a conceptual model at this stage of the process is to establish a shared understanding of how water, and access to water, is seen to impact on the Aboriginal values identified in Step 2. The model(s) should be designed to show how these interests and values respond to changes in water availability or management. The conceptual model(s) can be refined over time to illustrate the response of cultural and ecological values to cultural flows.

The conceptual model/s can be used to reach group agreement about the cultural flow assessment objectives.

1. Refine any existing conceptual models

Some conceptual models may already exist that are relevant to the watering place. These may be generic models of the ecology of the type of aquatic ecosystems that are potentially going to be watered or they may relate to a specific species or community of plants or animals. Such models may have been sourced in Step 1.

If existing models are sourced then review and refine these to suit the purpose of the cultural flow planning needs. It is unlikely that a model developed for another purpose will be totally suitable for use in the cultural flows assessment without some adaptation. In fact, the model is likely to go through a number of refinement phases as understanding of the relationships between cultural flow and values become clearer.

2. Agree on what the model will look like

Choose an appropriate style for presenting the model, keeping in mind the audience and purpose of the model. This basic model will be refined in a number of steps in the planning process and will ultimately be updated in the adaptive management cycle.

The key to a good conceptual model is to focus on the aspect(s) or issue(s) of interest and to represent systems as simply as possible. Conceptual models are best developed in an iterative manner and from a broad understanding of the cultural and ecological drivers, components and processes that operate within the proposed watering place and Country.

How the model is presented is best determined with guidance from the NCFWG and based on what is most appropriate and accessible for the Nation, in particular those that will be involved in the cultural flow assessment.

3. Develop the conceptual model

All of the information gathered in Step 2 is brought together and used to develop a conceptual model(s) of the values identified as being associated with the proposed watering place.

OUTPUTS

The minimum required outputs from Step 3 are:

- A conceptual model which captures the agreed values relating to, and aspirations for the cultural flow.
- A preliminary set of cultural flow objectives.

SUPPORTING RESOURCES

For logic and program logic models see:

- Logic Models (including templates, resources and examples), Program Development and Evaluation, University of Wisconsin-Extension: http://fyi.uwex.edu/programdevelopment/logic-models/.

For ecological conceptual models see:

- *Pictures worth a thousand words: A guide to pictorial conceptual modelling* Department of Environment and Heritage Protection 2012 https://wetlandinfo.ehp.qld.gov.au/wetlands/resources/pictorial-conceptual-models.html.

NCFRP EXAMPLE

In the NCFRP, the conceptual models were presented in the form of a Program Logic, which is a type of flow-chart that tells a story of logical progression as understood by the participants. A program logic model depicts a likely 'chain of consequences' over short, medium and long-term time horizons. In the group discussions that were used to build the model, the group was able to discuss and show how their plans for cultural flows linked to their long-term aspirations for knowledge sharing across generations and for economic independence.

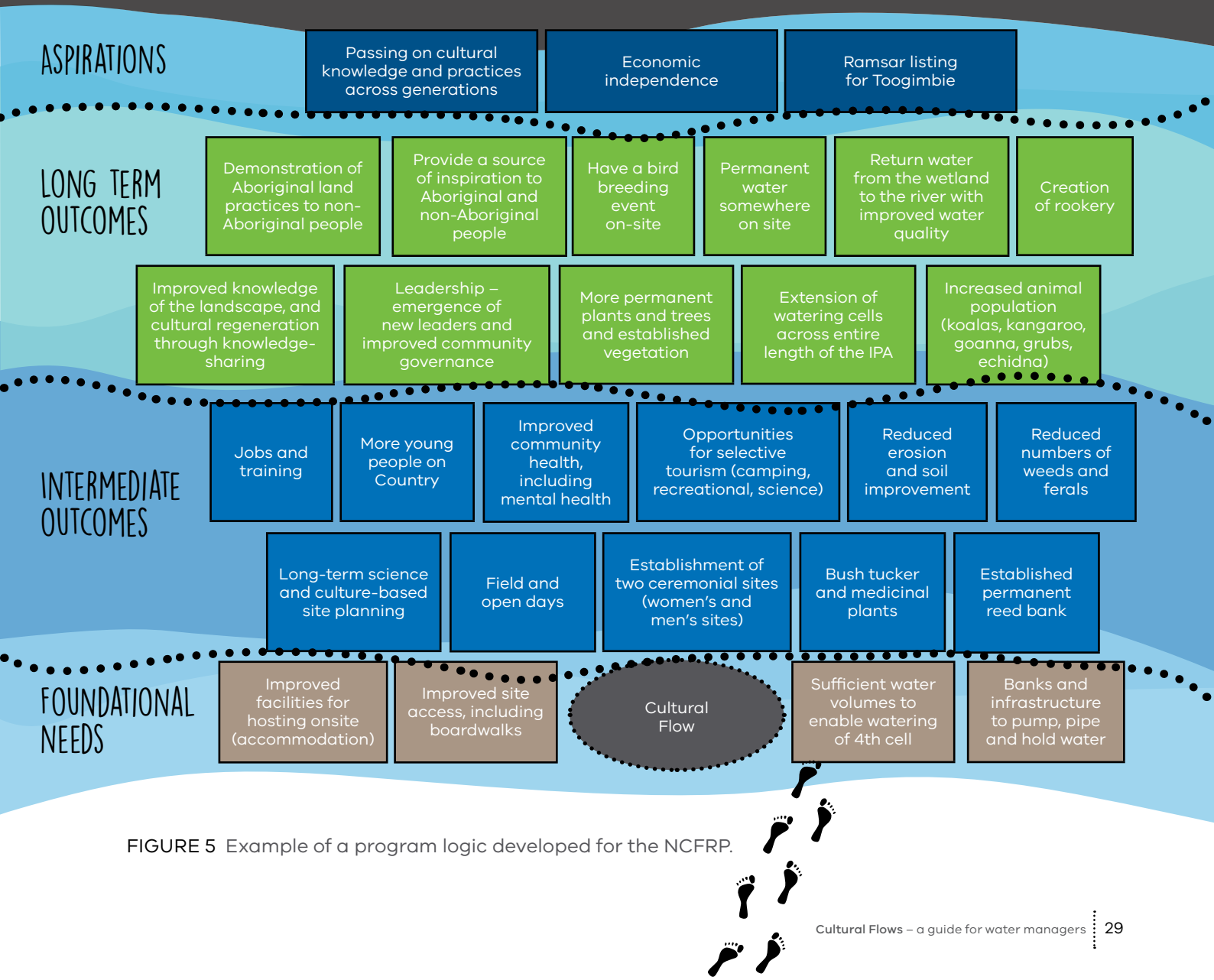
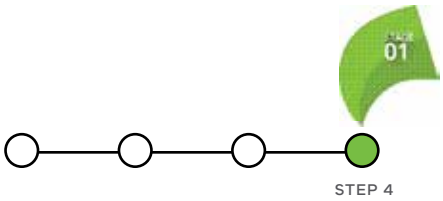


FIGURE 5 Example of a program logic developed for the NCFRP.

4 SET OBJECTIVES



AIM

To develop, confirm and prioritise objectives for your cultural flow.

KEY INPUTS AND DEPENDENCIES

- Output from previous steps.
- Agreed approach to sharing of knowledge and data.

ACTIVITIES

Consult the NCFWG to set objectives for the use of cultural water, based on the shared understanding established in Step 3. This may require the group to refine their understanding of the aspirations, uses and values and their relative importance. The activities undertaken in this Step are summarised in Figure 6.

1. Document all possible objectives for the cultural water

Document all objectives related to all the values identified in the previous steps. This is the first set of objectives, and will be refined in consultation with the Nation. The objectives for a cultural flow relate how a Nation wishes to manage the water, and how the management of that water can protect or enhance the identified values and contribute to the long term aspirations/outcomes.

2. Refine to a handful of key objectives

It is advisable to have a small set of well-crafted objectives, noting that water delivered for one objective may achieve outcomes for others.

The objectives are the foundation of the Cultural Flow Management Plan

LIST ASPIRATIONS	DRAFT OBJECTIVES	REFINE OBJECTIVES	AGREE ON OBJECTIVES
Aspirations are what a Nation wants to achieve through the delivery and management of cultural flows. This can include improvements to the health of Country, social or economic aspirations, among other things – it's the big picture, the long term goals.	Use the conceptual model and list of values to draft a set of cultural flow objectives. It is possible that some objectives suggested won't be able to be achieved with cultural flows and may require other actions.	Not all things will be possible, so having a small, well-targeted set of objectives is advisable. Select or prioritise the final set of objectives in consultation with the Nation. Make sure they are SMART objectives as this will guide and inform the monitoring and reporting of outcomes.	Get agreement on the objectives from all stakeholders. These objectives are what will be included in the Cultural Flow Management Plan, and underpin the assessment of the success of the cultural flow. The objectives should be reviewed over time as part of the adaptive management process.

FIGURE 6 Setting objectives.

This task involves identifying those that are critical to the achieving the Nation's aspirations for managing cultural water, and those which are desirable but not essential to achieving the aspirations.

3. Seek agreement on the final set of objectives

Cultural flow objectives should be reviewed and adapted based on NCFWG feedback to ensure they are feasible and realistic, and to assist in setting water requirements. To be effective, objectives should be SMART:

- Specific - clear and unambiguous. Wherever possible general statements as objectives should be avoided;
- Measurable - quantified, contain a measurable element that can be readily monitored to determine success or failure;
- Achievable - realistic and attainable;
- Relevant - considerate of temporal scale of response, resources available; and
- Time bound - specify a time scale in which the outcome is met or assessed.

SMART objectives can be developed by answering a series of questions such as:

- **What** do you want the cultural flow to achieve?
- **Where** do you want the outcome to be achieved?
- **What will you measure** to see if you achieved the outcome?
- **When** will you measure the outcome?
- **When will you have achieved** the outcome?

A non-SMART objective may simply be: Support culturally important species.

By answering the questions above, this might translate into the following SMART objective (example only, drawing on objectives developed with the Nari Nari):

Re-establish and maintain condition of culturally significant plant and animal species at Toogimbie IPA to allow continued practice of cultural activities by 2020.

a. *Improved condition of water dependent riverine and floodplain plant species of exceptional cultural importance, including Lignum (Duma florulenta), Nardoo and (Marsilea drumondii).*
b. *Increased number of successful breeding events of culturally important waterbird species (Black swan, ibis) by 2020.*
c. *Increased abundance of key harvest species such as Kangaroo and Emu by 2020.*

OUTPUTS

The minimum required outputs from Step 4 are:

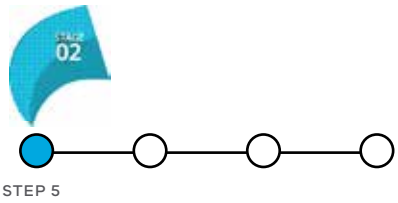
- A set of SMART cultural flow objectives that have been confirmed by the NCFWG.
- Documented any additional information requirements that can assist in the prioritisation and refinement of flow objectives.

THE GUIDE

STAGE
02

DEVELOP A **CULTURAL FLOW MANAGEMENT PLAN**

5 DEVELOP A CULTURAL FLOW MANAGEMENT PLAN



AIM

To summarise the cultural and ecological character of the watering place.

KEY INPUT AND DEPENDENCIES

- Completion of Stage 1.

ACTIVITIES

Using the information gathered for the watering place in Stage 1, a Cultural and Ecological Character Description (CECD) is prepared, which summarises both the TAK and Western Science understanding of the water dependent characteristics of the place.

The characterisation should focus on the water dependent components, processes, functions and services that may be affected by a cultural flow or other changes to the water regime. The characterisation will be a standalone section in the CFMP.

The summary characterisation should include:

- Catchment and river system overview;
- Watering place description including spatial boundaries;
- Traditional Aboriginal Knowledge;
- Known ecological values;
- Ecosystem types;
- Ecosystem components;
- Ecosystem processes and functions;
- Ecosystem services;
- Threats to cultural character; and
- Character conceptual models illustrating relationships between values and threats (see Figure 7).

OUTPUTS

The minimum required output from Step 5 includes:

- A summary of the CECD of the watering place for inclusion in the CFMP.
- Character conceptual models.

OTHER CONSIDERATIONS

In this context, TAK refers to traditions, beliefs, and worldviews based on direct experience, testing, and observation of patterns, teachings and recordings in the collective memory through oral tradition, storytelling, ceremonies and songs specifically relating to water. It is a holistic and inclusive form of knowledge.

TAK can exhibit a range of forms including site specific characteristics associated with past or desired water conditions or observed ecological responses of culturally important species and ecosystems to water.

SUPPORTING RESOURCES

For more information about preparing a characterisation refer to DEWHA (2008), noting that only a summary characterisation is required in the CFMP.

A number of online resources are available (see Step 1 also) which may provide information that can be used to develop the characterisation:

- State government agencies (i.e. Department of Environment, Water and Natural Resources, Department of Water, etc.).
- Catchment Management Authorities (CMAs), NRM Groups and Boards (or similar bodies).
- Local community and/or study groups (e.g. Birds of Australia).

For each of the NCFRP case study sites, a detailed characterisation was prepared; largely based on Western Science but emphasising Traditional Aboriginal Knowledge and information where it was available. The detailed description of the water dependent values and how they potentially related to different wetting and drying regimes were then illustrated in a pictorial conceptual model. Where possible, nation languages and Traditional Aboriginal Knowledge were embedded in the characterisation report.

The numbers in white circles represent key ecological components, processes and services or benefits that would result from a cultural flow allocation; those in orange represent the cultural outcomes.

1. Promotes lateral connectivity between floodplain and parent river;
2. Water is turbid which in turn affects rates and levels of primary and secondary production;
3. Watering triggers emergence of invertebrates from the egg bank, triggering a boom in secondary production (i.e. food for waterbirds and frogs);
4. Lignum, the target vegetation species, undergoes growth and reproduction;
5. Presence of water supports a diversity of birds predominantly ducks, grebes, swan, spoonbills, ibis and rails and crakes;
6. Increased health and density of lignum supports waterbird breeding (nesting sites);
7. Proliferation of harvest species, including bushfood, iconic fauna species relied upon for hunting, and the availability of plant species for medicine, artefacts, ceremony and culture enable traditional practice;
8. Cultural management of the site through traditional practice fulfils cultural obligations for the maintenance of artefact, burial and occupation sites, connected to the belief in the continuing spiritual presence of ancestors in the landscape;
9. Greater access to traditional medicine and participation in cultural management of Country present benefits associated with mental health and wellbeing improvements of Aboriginal people on Country, reduced influence of drug dependence of community members involved, and regional scale public beneficial health outcomes;
10. Support for culturally significant species;
11. Rapid drying during summer results from high temperatures and increased evaporation as the wetland is shallow. With the onset of drying waterbirds will move onto other systems, with the cycle beginning again with the arrival of water into the system.

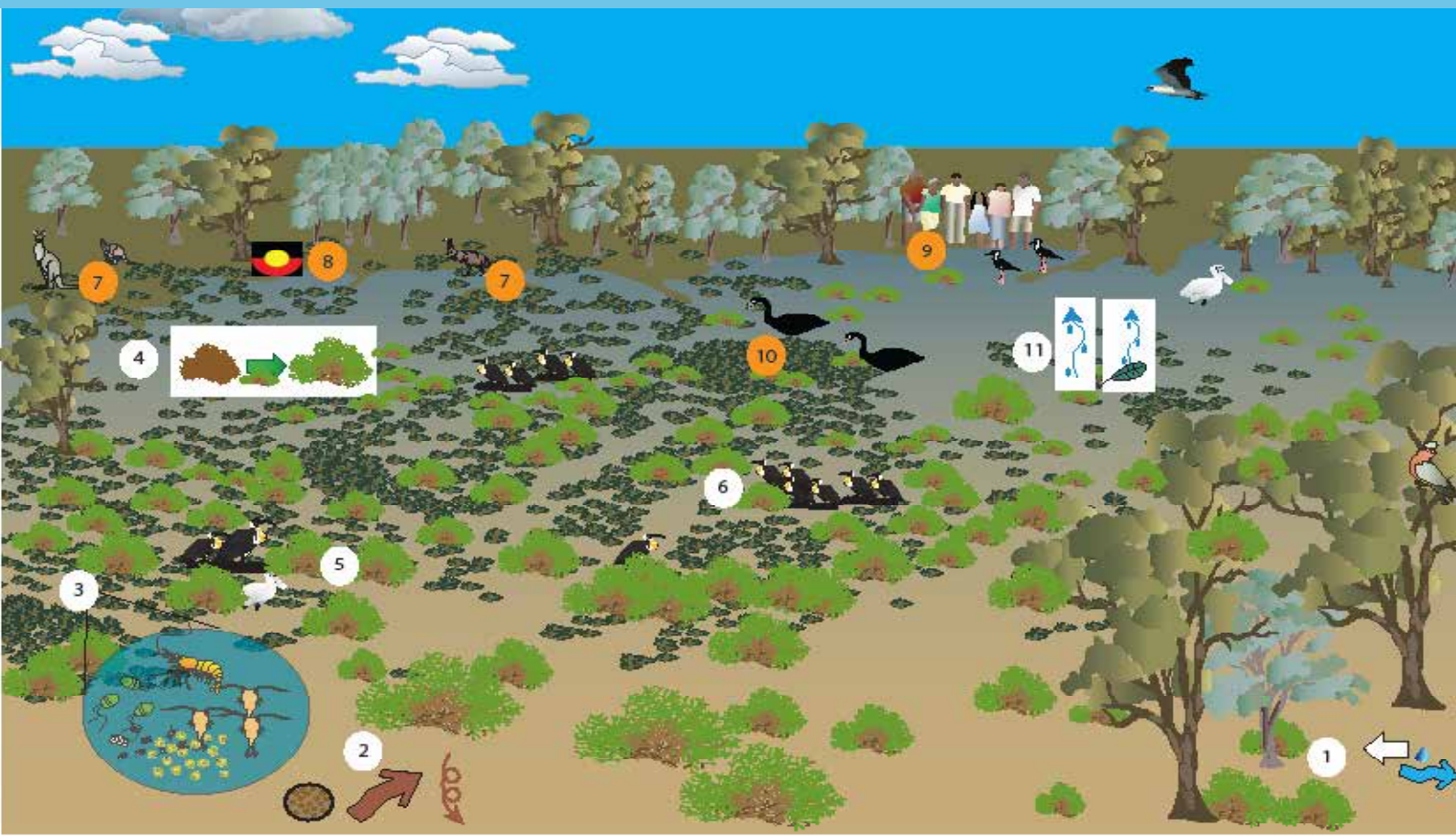


FIGURE 7 Lignum shrubland swamp character conceptual model developed for the Toogimbie wetlands.

6 CONFIRM CONCEPTUAL RELATIONSHIPS

AIM

To confirm and document the conceptual relationships between cultural values, aspirations, objectives and water requirements.

KEY INPUTS AND DEPENDENCIES

- Models sourced or developed in Stage 1.
- Agreed values, aspirations and objectives for the watering place.

ACTIVITIES

The Nations' water values and the cultural and ecological understanding of the water resources from the previous steps are compiled to provide an integrated perspective of the relationships between aspirations, objectives and watering requirements. This involves the participants refining the conceptual models developed in Stage 1 to clearly articulate the relationships between the water resource and the values. This is part of the iterative process of building understanding of how the characteristics of the place interact and respond to different watering options.

Some of the questions the NCFWG and participants may need to work through at this stage could include:

- How are the identified values related to environmental water, stream flow and water availability?
- How do those socio-cultural values intersect and interact with the ecological, economic and social dimensions of the resource?
- How do changes in the availability of water impact on those values?
- Under what range of scenarios are those values risked or impacted by changes in water availability?
- What quantities of water are necessary to meet the array of socio-cultural values?
- If quantities are not determinable, what are the specifications of the water requirements, in terms of magnitude, timing, duration and water quality?
- What are the thresholds and tipping points for ensuring that those values are maintained?
- What are the threats and pressures on the delivery of water for socio-cultural purposes, and to what extent are water allocation decisions able to influence or mitigate against those threats and pressures?

As the conceptual understanding combines cultural, social and environmental information, it allows a more holistic and inclusive platform from which to support decision-making, communication and predictions relating to cultural water management. This will form a critical component of the CFMP.

Risks to achieving the desired objectives and outcomes should be identified and documented as part of this step.

OUTPUTS

The minimum required outputs from Step 6 are:

- A series of updated models that capture technical and values information demonstrating the relationship to watering options.
- Known or potential risks to achieving the watering objectives.
- Narrative to support the conceptual understanding between values, aspirations, objectives and water requirements.
- Ideally, the outputs from this step should be sufficiently detailed to be capable of demonstrating impacts and effects of different water regimes.

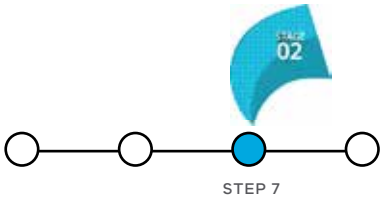
SUPPORTING RESOURCES

There are a range of tools available to support this type of integrated assessment which can incorporate qualitative data, opinions and uncertainty.

These include:

- **RiVAS:** The River Values Assessment System (or RiVAS) is a multi-criteria based assessment tool that uses an expert panel methodology to enable river reaches, sites or a set of rivers to be prioritised for any specified value (Hughey & Baker 2010).
- **Shared Vision Planning:** Developed by the U.S. Army Corps of Engineers during the National Drought Study, the approach is described by Connor *et al.* (2004) as the integration of technical analysis into a planning and negotiation process through the use of collaborative modelling.
- **Bayesian Belief Networks:** Bayesian belief networks (BBNs) are dynamic modelling tools that integrate multiple and diverse data sets into a formal set of relationships between variables (Cain 2001; Lynam *et al.* 2007).
- **Holistic Environmental Flows Assessments:** The "holistic" methods for determining environmental flows appear capable of effective integration of socio-cultural values into a systemic model.

7 QUANTIFY WATER REQUIREMENTS



AIM

To quantify the water requirements that will achieve the agreed cultural flow objectives at the watering place.

KEY INPUTS AND DEPENDENCIES

- Information and data from all previous steps of the Guide.
- Specific requirements include data that characterises the topography (landform shape), climate, river flow (if relevant), groundwater levels (if relevant) and soil.
- An understanding of how water naturally flows to the watering place. This hydraulic information might be available from existing sources, otherwise it will need to be collected or modelled.
- Satellite imagery might also be useful.

In most cases, these input data can be downloaded for free, but technical work is required to check, analyse and combine the data to gain an understand of the hydrology of the watering place.

ACTIVITIES

1. Specify objectives in terms of water requirements

It is important that the cultural water objectives are expressed in a way that allows estimation of how much water will be required and when it will be required. This means that a table is needed that lists the cultural flow objectives, and for each, the desired depth (or water elevation), volume, area covered, velocity (if a flowing water place), duration of water presence, and frequency that water should be present. It might be possible to group objectives if they have similar water regime requirements.

Work to prepare the table should start early on in the cultural flow assessment process. The information in the table will usually be general at the start, but will become more refined and specific as information is obtained and the objectives become clearer. The table must be completed before the volume of water required can be estimated.

The table of objectives and associated desired water regimes is useful not just for estimating the volume of water required to meet the objectives, but also as a guide to ongoing management of water at the watering place.

2. Calculate how much water is needed

Working out the volume of water required in Megalitres (ML) in each watering event, in dry, wet or average years, or the average over a longer management timeframe, is obviously going to involve calculations. There are different ways that these calculations can be performed. The work can be done by the Nation if people with the necessary skills and experience are available. Otherwise, the Nation should seek professional assistance.

While a rough estimate of the volume of water required could fairly easily be made, there is a risk that such an estimate would not be considered sufficiently accurate as the basis for a business case for a cultural water allocation. Also, in river systems where water is scarce, rough estimates of water needs could attract criticism from other competing water users.

3. Determine how the water will be delivered

Cultural water might be provided by natural overbank floods, or by naturally rising water tables, but in many cases, where the natural water supply has been reduced or altered, it will be necessary to work out how to get the cultural water from the source, usually a nearby river, to the watering place. Having a feasible way to do this will be an important part of the business case to obtain a cultural water allocation.

There are a number of ways to get water to a floodplain, such as pumping, diversion and gravity flow through channels or pipes, modifying river levels by special releases from storages, or by having rules that prevent or limit upstream users extracting water from the river at the times when cultural water is required.

Solving these issues can be done by the Nation if people with the necessary skills and experience are available. Otherwise, the Nation should seek professional assistance.

4. Agree on how much water is required to achieve objectives

The final activity of this step is to obtain understanding and agreement on the amount of water required to achieve the cultural water objectives so that the Nation can confidently request an allocation, or if the Nation already has an allocation they can go ahead and manage it in a way that is likely to achieve their objectives.

OUTPUTS

The minimum required outputs from Step 7 are:

- Estimated annualised long-term average and range of volume of water required to meet cultural water needs, for the purpose of seeking an allocation. Volume is expressed as an amount per year, even if the water is used less frequently than annually.
- Annualised estimates of associated variables of interest, including the electricity or fuel costs to deliver the watering place.
- Modelled time series of the likely future water regime of the cultural flow places, which also indicates the expected pattern of frequency and timing of cultural water delivery.
- When a cultural water allocation is available, for the upcoming watering season, forecast water requirements for the purpose of water ordering, based on agreed season management objectives, antecedent local weather conditions, and recent watering place inundation history.
- Detailed operational tables and manuals that specify the triggers, thresholds, limits, rates, mechanisms, conditions and other necessary information required by water managers to implement the cultural flow in a way consistent with the aim of maximising the likelihood of achieving the flow objectives, and meeting all licence requirements and other obligations.
- Descriptions of any infrastructure or modifications required to operationalise the cultural flow, i.e. the means and mechanism of transferring cultural water from the source to the watering place.
- Hydrological and hydraulic models freely available on a platform accessible for ongoing basic use by lightly-trained non-experts (i.e. not model developers).
- Comprehensive technical report on model development, covering input data, methodology, uncertainty, error, and sensitivity.

OTHER CONSIDERATIONS

In most cases, determining the volume of water required to achieve agreed cultural water objectives will require calculations. These are performed by models, known as hydrological and hydraulic models. This is standard modelling that forms the basis of all water management in Australia. For example, water agencies use hydrological models, together with monitoring data, to understand how much water is available for sharing, distribution and storage throughout catchments and basins at any time, and to forecast how much is likely to be available in coming seasons.

When agencies undertake environmental flow assessments to work out how much water should be allocated to maintain ecological integrity of river systems, they use hydraulic and hydrological models to assist with obtaining the answer.

Irrigators might not need to develop a hydrological model to obtain an allocation of water, but they would normally make regular use of hydrological modelling tools, along with river flow, soil moisture, climate data, and knowledge of crop water use, to help them manage their existing allocations efficiently, so as to maximise productivity.

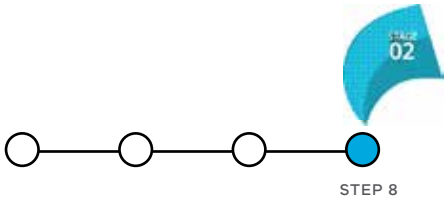
The modern system of water sharing and distribution in Australia relies on numerical hydraulic and hydrological models, supported by river flow and climate monitoring data. Interaction by Nations with this system is going to require gaining an accurate numerical understanding of their cultural water requirements through the application of hydrological and hydraulic models.

Additional information and considerations for undertaking hydrological investigations can be found at www.culturalflows.com.au

SUPPORTING RESOURCES

This step requires technical expertise. If this expertise is not held by the Nation they will need to seek assistance. Sometimes water resource management agencies might be able to assist, and sometimes hydrological and hydraulic models might already exist that cover the watering place. Even so, it is unlikely that existing models, created for another purpose, will be immediately applicable to the particular case of cultural flow assessment. The models might need updating, modification, and at least, re-running to suit the purpose of cultural water estimation. Two worked case studies for Gooraman Swamp and Toogimbie can be found in the National Cultural Flows Research Project hydrology report (NCFRP 2017c).

8 PREPARE A CULTURAL FLOW MANAGEMENT PLAN



AIM

To prepare a Cultural Flow Management Plan (CFMP) that outlines the objectives of the cultural flow(s), how much water will be required, how water will be accessed (where will it come from?), how water will arrive at the place(s) where it is needed, and how it will be managed.

KEY INPUTS AND DEPENDENCIES

- This step builds on all of the previous steps, particularly Steps 4 and 7.
- Key dependencies include the ongoing interaction between those who developed the cultural flow objectives and those involved in accessing and managing the water, both on its way to and at the place where it is to be used.

A CFMP will be an important document for interacting with other stakeholders potentially involved with, or affected by, a cultural flow. Stakeholders may include organisations such as State and Territory Government agencies and authorities, the Commonwealth Environmental Water Office and Department of Environment and Energy, Murray Darling Basin Authority, Lake Eyre Basin Ministerial Forum and Senior Officers Group, as well as regional catchment and NRM management authorities and councils.

ACTIVITIES

1. Engage with water authorities and agencies

Accessing water and then getting it to where it is needed will not occur in isolation. It will usually include interactions with various government agencies and water authorities, particularly if the water to be accessed is distant from the place where a cultural flow is to be directed. There are numerous factors that might influence how much water will be required, when it will be needed and when it can be delivered. The decision making process for water management varies in each jurisdiction.

2. Consider risks in planning

Identification of risks to achieving the outcomes of the cultural flow is an essential part of the development of the CFMP. Planning should include flexibility in objectives that might be addressed year-to-year or even season-to-season. For example, natural flooding disrupted the planned delivery of water to achieve outcomes at Toogimbie Wetlands (NCFRP 2016h); some planned objectives were achievable with the flood but others were not. Climatic conditions and water availability vary from year-to-year; to mitigate this type of risk some agencies develop objectives that can vary according to prevailing climatic conditions and water availability (e.g. CEWO 2014, 2015).

Getting water to a place might be constrained by waterway capacity between the source of the water and its destination, and may pose a risk to achieving desired outcomes. Assessment of risks associated with the delivery of water, both on the way to and at the water destination, should be considered early in the water planning process. This will allow time for enhancement or mitigation measures to be identified and implemented, if required, before water access commences.

3. Prepare the CFMP

The final activity is to actually write the CFMP (Figure 8).

Getting access to water

Getting access to water could be straightforward if some form of cultural access licence is available (this might apply for both surface and groundwater). Securing an allocation is a separate process to developing the CFMP and is outside the scope of the Guide. In most instances though, water will have to be obtained from some other source, particularly in heavily regulated systems or in areas where there has been extensive allocation of water already.

Nations seeking access to water for use as cultural flows will likely have to work together with government agencies and other natural resource managers and users. The scale and number of organisations that might be involved will depend on location of the place of interest, where the water will come from and how it might be delivered. The roles and responsibilities for water planning vary across Australia, with the range of variation including the process being relatively contained within a single central agency to regional NRM organisations taking responsibility for annual planning (Watts and Butcher 2015)

OUTPUTS

A detailed CFMP, outlining the planning and operational activities required for the delivery of water to the place. The plan should include:

- A background description of the place to receive a cultural flow.
- An overview of the catchment or river system setting.
- A summary of cultural and ecological values.
- Clear objectives for the cultural flow(s).
- A description of how water will get to and be managed at a place (including costs, on site management, constraints).
- Summary of stakeholder engagement.
- A risk assessment and description of mitigation measures, if required.
- How the arrival and use of water at a place will be monitored.

Other considerations:

Water delivery will require collaboration with government and water management organisations; allowing time for such collaboration should be factored into the water planning process. An allowance should also be made for travel time if water is to be sourced from surface water storages and transported using existing infrastructure – water sourced from upstream storages can take days to weeks to arrive. Waterway capacity constraints can also affect the timing of water delivery, and discussions with water delivery partners will help identify potential barriers to a timely arrival of water.

CULTURAL FLOW MANAGEMENT PLAN WRITING STEPS

The Cultural Flow Management Plan will be the key document that describes how your cultural flow will be implemented and managed.

Underpinning the Cultural Flow Management Plan will be an understanding of how the water will be delivered, who will be involved and what stakeholders need to be engaged.

SET CONTEXT AND DESCRIBE THE WATERING PLACE

State why you are preparing a Cultural Flow Management Plan – state the aspirations of the Nation.

Describe the boundaries of the chosen watering place.

Use the conceptual models and list of values to describe the character of the site – basically this is the output from Step 5.

STATE THE OBJECTIVES

List the main objectives that were prioritised in Step 4.

STATE WATER REQUIREMENTS TO MEET OBJECTIVES

Describe what you need for the watering (infrastructure, timing, volumes, frequency of watering).

Include requirements under wet, dry and average climate.

DOCUMENT THE RISKS

Record all of the risks you identified with the cultural flow. This will probably include what happens if the flow is delayed, if there is flooding or if less water is delivered.

INCLUDE A MER PLAN

Describe the monitoring, evaluation and reporting you will do to assess if you have achieved your watering aims. This will inform Stage 3.

FIGURE 8 The elements that go into creating the CFMP.

SUPPORTING RESOURCES

The water management plan developed for Toogimbie IPA (NCFRP 2016h) can be used as a template for other cultural flow management plans. Environmental water management plans, for example those developed by the Commonwealth Environmental Water Office (e.g. CEWO 2015), also contain the types of information useful in CFMPs. It is recommended that those developing CFMPs discuss the type and level of information that might be needed with partner organisations (i.e. relevant water authorities) that have a role in getting water to a place. These partner organisations are likely to have existing water plans that will provide valuable information of relevance to cultural flows. It is important to note that specific water planning processes will vary in each state or territory. The elements in water planning are summarised in Figure 9.

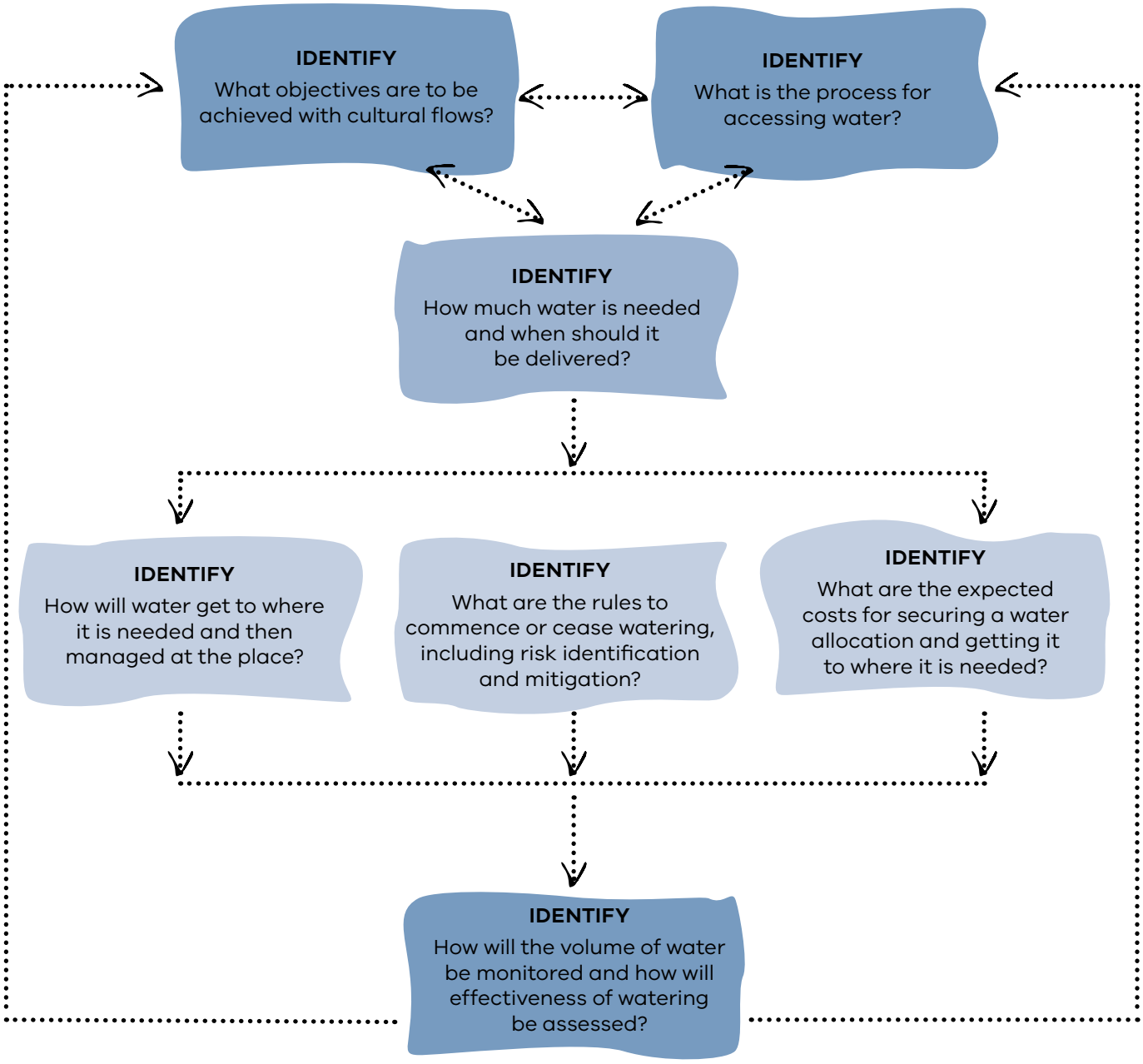
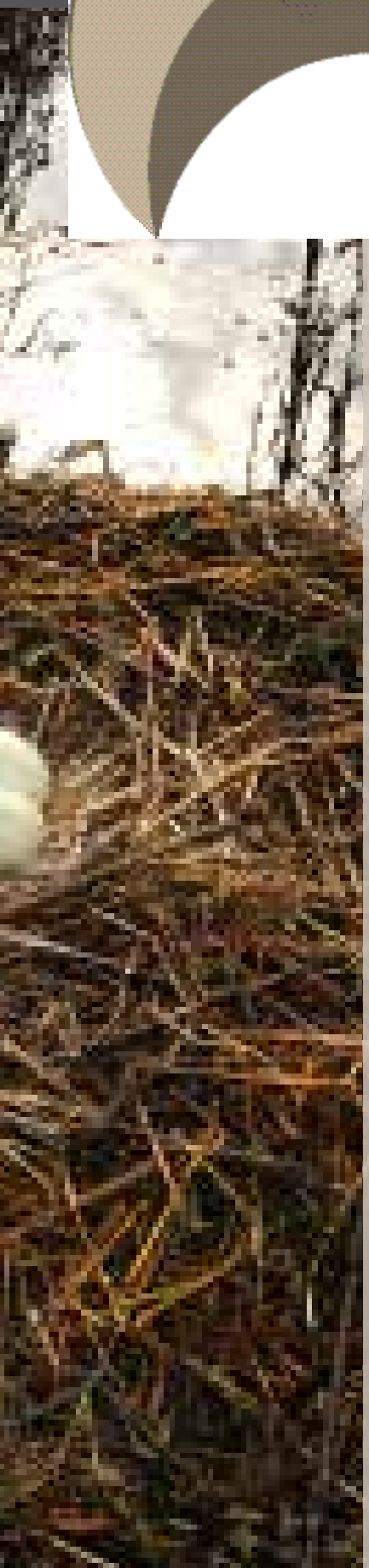


FIGURE 9 Overview of the water planning process.

THE GUIDE



STAGE 03

MPLEMENT THE MONITORING, EVALUATION AND REVIEW OF OUTCOMES

The overall aim of Stage 3 is to develop and implement a monitoring and evaluation program from which to assess the effectiveness of cultural flows in achieving their stated objectives (often expressed as Key Evaluation Questions or hypothesis testing). The overall process is summarised in Figure 10 as a series of questions to be considered.

The results and insights gained from this process can then be used to guide the review of objectives and management of cultural flows, so water can be used as effectively as possible in the future.

It is important to note that alternative sources of advice might be consulted at various points in Stage 3, should the required expertise not be available within an Aboriginal community. This is most likely to occur in relation to details of indicator selection, study design and data analysis.

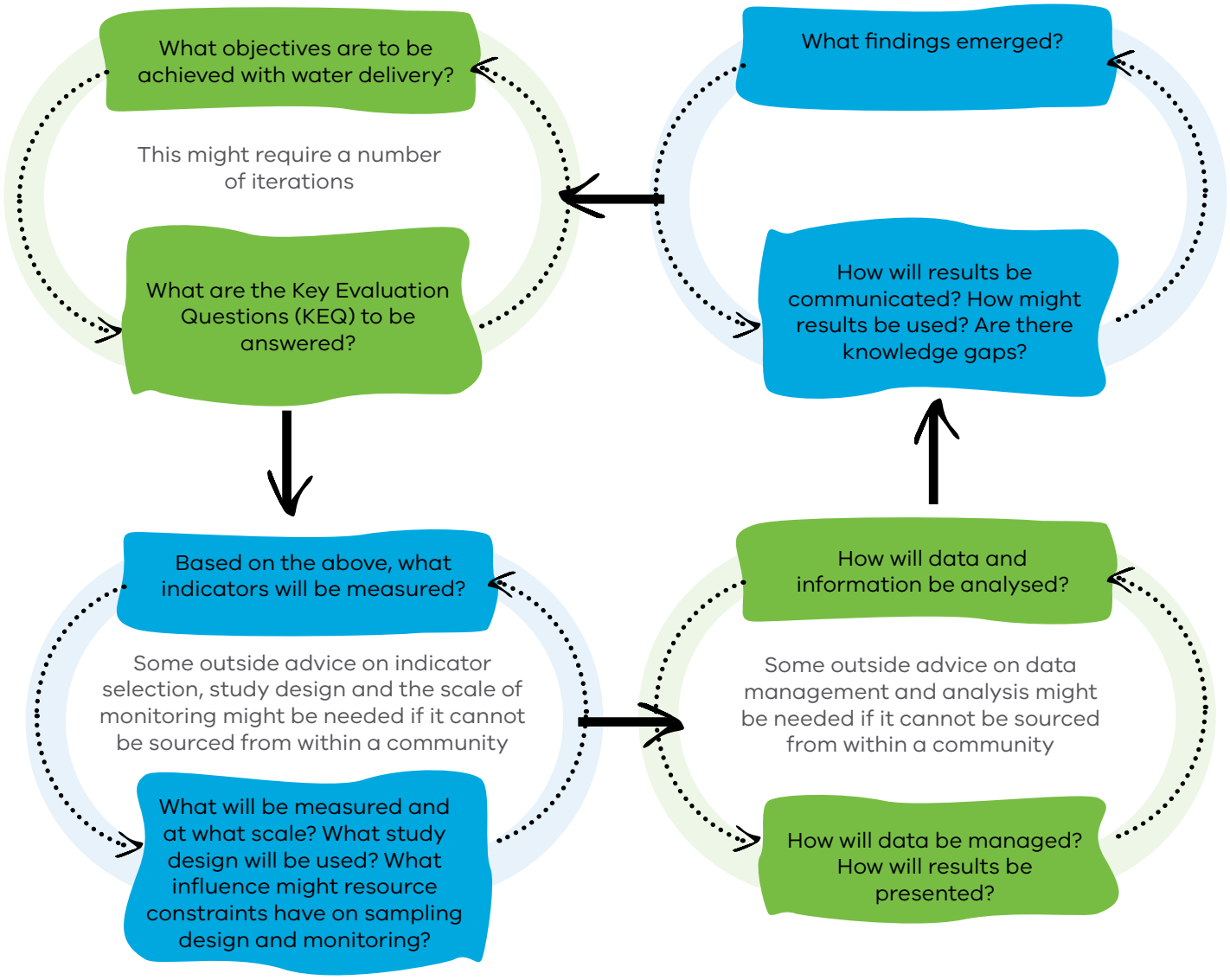


FIGURE 10 General considerations when developing a monitoring and evaluation framework.

9 DESIGN MONITORING REQUIRED AND COLLECT DATA

STEP 9

AIM

To design and implement a monitoring and evaluation program, which includes identifying and selecting appropriate indicators to assess the objectives and expected outcomes of the cultural flow.

KEY INPUTS AND DEPENDENCIES

- Key inputs to this task will include Step 4 (agreed objectives) as well as the characterisation of the place undertaken in Steps 3 and 5.
- A confirmed cultural flow allocation (how much water and when) and delivery arrangement to get water to the watering place from relevant water authorities.
- There will be some overlap with the description of monitoring requirements as stated in the CMFP but this step produces a detailed study design.
- Resources (people and financial) available for undertaking the monitoring and evaluation.

ACTIVITIES

The monitoring and evaluation program outlines how to assess the effectiveness of the cultural water allocation in achieving the objectives stated in the CFMP, and planning needs to be completed well before a cultural flow is due to be delivered. Study design is important as it will greatly influence how Nations determine if outcomes observed are mainly a response to the cultural flow event, or due to some other factor(s) (e.g. natural events, or just within normal variation). Study design considerations include the desirability to measure indicators before and after cultural water gets to where it is needed (and also possibly during water delivery), and if possible include comparison of outcomes with some form of reference or control place (e.g. a reference place that represents a desired future condition, or a control place that is similar to the place of interest but that does not receive a cultural flow). There are a large number of guides available to help Nations and the NCFWG develop the monitoring and evaluation program.

The general steps involved in monitoring and evaluating the outcomes of cultural flows outlined in Figure 10 have been posed as questions to be considered and are consistent with those included in many natural resource Monitoring, Evaluation, Reporting and Improvement (MERI) framework and adaptive management programs.

1. Restate objectives and expected outcomes

The monitoring program will be directly linked to the objectives for the cultural flow. It should be designed in terms of what to measure, when, where and how often. The first step is to restate the cultural objectives and expected outcomes (e.g. social, cultural, ecological and economic), so that it is clear that the monitoring and evaluation program is directly linked to these objectives.

2. Getting help and building capacity

The design, implementation and analysis of a monitoring program to assess cultural outcomes associated with cultural water management may in some circumstances be straight-forward but can often be quite a challenging exercise, particularly if it deals with complex social or environmental responses. If the capacity does not exist in the existing NCFWP or the Nation, then get help from a researcher or water manager who has experience in designing MERI programs. It may also be useful to engage a statistician. Ultimately the monitoring program should be designed to be implemented by community members where possible and to build capacity within the Nation at all stages of planning, assessment, evaluation and reporting.

3. Select indicators linked to objectives

The selection of indicators to monitor should have strong conceptual links to the stated objectives. Expand on the conceptual models developed in previous steps to help select indicators. For example, if a cultural flow objective is to increase the abundance of an important medicinal plant over a nominated period (e.g. months or years), then the relevant indicator will be the abundance of the species, before (when possible) and for a period after the cultural flow has arrived (i.e. to match the period over which the outcome is expected).

Often there will be very limited financial resources available for monitoring, and there may only be a limited capacity for local Aboriginal communities to design or undertake monitoring on their own. Such factors will greatly influence what indicators can be included, and how long monitoring might continue. Should there be limited sources of expertise on indicator selection and monitoring design within an Aboriginal Nation then it is recommended that alternative sources of advice are sought to assist with selecting indicators and assessing which of them provide the best return in terms of assessing outcomes, given available resources. This advice might come from many sources, including government agencies, universities and consulting organisations.

4. Sampling methods and study design

Much attention has been given to the design of monitoring programs in biology and natural resource management, and resources such as Downes *et al.* (2002), Quinn and Keough (2002), and DEE (2017) are highly recommended references for those designing projects to assess cultural flows. For developing socio-economic and cultural monitoring and evaluation, Fisher (2012), Walsh and Mitchell (2002) and Smyth (2011) are useful resources for the cultural management of resources, including cultural flow assessment.

Study designs for monitoring programs commonly involve some form of before-after comparison – what were the cultural values like before the cultural flow event and how did they change after the water event? This is just one type of study design however, and the final design will depend on the chosen objectives and indicators.

In general, when collecting data it is important to document the location, timing and frequency of data collection, often in association with GPS data. Document who will be involved and what methods will be used to collect the data. If the expertise is not available within the Nation then external expertise will need to be engaged. The cost of engaging expertise will be a factor in the overall monitoring design.

5. Data storage

An often over-looked consideration is how best to store and manage data once it is collected. Data might initially be collected in various formats (e.g. verbally, on paper, electronically). Development of a data management plan is recommended, so that provision is made for the appropriate storage and management of data and information that is collected, particularly culturally sensitive information. This helps protect a valuable resource and ensure it is available in the future, as appropriate. Very importantly, it should be made clear where the data is to be stored and who has responsibility for managing it. Again, seeking advice from the NCFWG or external expertise may be required at this stage.

6. Detail how the data will be evaluated

Like most aspects of monitoring, the data analysis can be complex and require specialist expertise. If this expertise does not exist within the Nation or NCFWG, it is recommended that alternative sources of advice are sought on such things as standard methods, the scale at which data should be collected, and how data might be analysed. This part of the monitoring program should document how the data will be analysed and evaluated.

7. Collect the data (before, during and/or after the water arrives)

Monitoring data will need to be collected at a number of stages, depending on the design of the monitoring program. In the case of a before-after study design, indicators will need to be measured before and after (and possibly during) a cultural flow. This will allow changes in those indicators to be observed and recorded, and allow for the success of the cultural flow to be evaluated. Field data sheets can be used to record the data collected – cultural flows field data templates can be found at www.culturalflows.com.au

Other information to be recorded and reported on during data collection includes problems or issues arising during the field work. It could be that a method is found to be unsuitable, or it was too difficult to access a location. If some of these issues can be identified before the cultural flow arrives (i.e. during any "pre-flow" monitoring) it may be possible to make modifications to the study design before the flow arrives. Otherwise, improvements can be made for future monitoring programs.

OUTPUTS

At the end of this step, the NCFWG will have a monitoring and evaluation plan, separate to the CFMP that includes:

- A summary of values, objectives and outcomes expected with the use of a cultural flow.
- A description of the linkages between objectives and indicators selected for monitoring.
- A description of indicator methods and data collection.
- A description of study design (e.g. the number of localities at a place where monitoring occurs and timing of data collection).
- A description of how data will be stored and managed.
- A description of how data are to be analysed.
- Data relating to indicators that have been measured during implementation of the monitoring program.

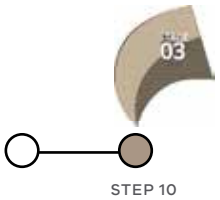
OTHER CONSIDERATIONS

Aboriginal Nations may wish to consult with other research or water management organisations about recent or existing monitoring and assessment. It could be useful to check if other organisations are aware of monitoring that may complement what is proposed for a watering place. Similarly, an Aboriginal Nation that intends to use a cultural flow may wish to consult with other nearby Nations to see if there are areas of common interest and ways in which Nations may support each other. Other Aboriginal Nations may have their own insights that could be useful in terms of culturally appropriate objective setting, indicator selection, monitoring data collection methods, or previously collected data.

SUPPORTING RESOURCES

- Monitoring plans for Toogimbie IPA and Weilmoringle (NCFRP 2016d and 2016e).
- National Cultural Flows Research Project (NCFRP) 2017a. *NCFRP Field Work Results and Findings Report.* Unpublished Report prepared for the Research and Planning Committee. Rural Solutions SA, Adelaide, South Australia.
- Downes, BJ, Barmuta, LA, Fairweather, PG, Faith, DP, Keough, MJ, Lake, PS, Mapstone, BD, & Quinn, G 2002, *Monitoring ecological impacts: concepts and practice in flowing waters.* Cambridge University Press, Cambridge, UK; New York, NY, USA.
- Quinn, G, & Keough, M 2002, *Experimental design and data analysis for biologists*. Cambridge University Press. Cambridge, UK; New York, NY, USA.
- State and Territory water management agencies such as Catchment management authorities or similar bodies.
- Commonwealth Environmental Water Holder.
- Murray Darling Basin Authority.
- Australian water resources information system (Bureau of Meteorology).
- Geoscience Australia Landsat Satellite Imagery holdings.
- Australian Bureau of Statistics and Australian Bureau of Agricultural and Resources Economics and Sciences.
- University and local community and research groups.
- Local Government.
- Industry bodies.

10 REVIEW, REPORT AND IMPROVE



AIM

To evaluate the outcomes of the cultural flow, analyse the collected data and report the findings of the cultural flow assessment.

KEY INPUTS AND DEPENDENCIES

- Cultural flow objectives as specified in Stages 1 and 2
- Data and information from the monitoring work undertaken in Step 9

ACTIVITIES

The knowledge gained from this review and evaluation process will help to improve the on-going management of cultural flows. Information and learning from evaluation should feed back to each different stage of the process for future iterations, ensuring on-going improvement and effectiveness of cultural flows.

Information from the monitoring process is assessed, either by the NCFWG, in participation with individuals impacted by the cultural flow, and/or by an independent third party.
In particular, this information is assessed against the objectives and the aspirations identified for cultural flows in the planning stage.

This review process should consider:

- Process: how effective and efficient was the planning, level of community involvement, principles and protocols followed?
- Outcomes: what was achieved, and how did this compare to the original objectives?
- Impact: what changes to human wellbeing and ecosystem health have occurred as a result of the cultural flow?

OUTPUTS

The results should be used to consider whether or not the stated cultural flow objectives have been met, and whether any adjustments in future water management or use might be required.

OTHER CONSIDERATIONS

Important considerations here are the target audience for the results, the form of presentation of results, and how the results are used.

SUPPORTING RESOURCES

- NCFRP2017a. *NCFRP Field Work Results and Findings Report*. Unpublished Report prepared for the Research and Planning Committee. Rural Solutions SA, Adelaide, South Australia.

To assist with the evaluation process, the following questions are recommended for a structured participatory evaluation process, including for use in focus groups, interviews or surveys:

- How satisfied overall are you with the flow trial process?
- Was there sufficient opportunity to present ideas and raise questions?
- Was the process responsive to issues and concerns raised by participants?
- What controversies arose through the process? How were these resolved?
- Was the group able to reach agreement? If not, what were some of the barriers to reaching agreement?
- Was the information presented accessible, digestible and sufficient?
- In your opinion, has the flow trial achieved what it set out to achieve?
- Did the community engagement process add value to the final outcomes? What would have been achieved without the aspiration and objective discussions?
- Were the time and resources allocated to the process adequate? Could the resources allocated have been used more efficiently?
- Has it had an impact in the community?
- How do people who have not been directly involved perceive what was achieved? Do they think the process was useful? Would they like to be involved in future activities?
- How could the process be improved for future cultural flow trials?
- What other comments would you like to make about the cultural flows study and process?

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TERMINOLOGY AND DEFINITIONS

TERMINOLOGY AND DEFINITIONS

Aboriginal	The people who are the original inhabitants of the land.
Aboriginal Environmental Outcomes	The term "Aboriginal environmental outcomes" has been developed to describe and communicate the benefits to Aboriginal people that can be derived from environmental watering. Aboriginal environmental outcomes result from healthier rivers and wetlands, for example improved fish populations, more reeds that can be harvested and increased bird breeding events. In essence, Aboriginal environmental outcomes provide tangible physical benefits to community and country (MLDRIN 2007). This definition was endorsed by representatives of the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) and Northern Basin Aboriginal Nations (NBAN) and is recognised by the Murray Darling Basin Authority (MDBA), Victorian Environmental Water Holder (VEWH) and Department of Environment, Land, Water and Planning (DELWP).
Authorised Knowledge Holder	A person, normally a Traditional Owner, who has been provided cultural and/or traditional knowledge of a particular place or thing through customary law and is recognised by the Traditional Owner community to have the authority to speak on or share that particular knowledge where appropriate.
Community	A group of people living in the same place or having a particular characteristic in common (e.g. people living in a suburb or town).
Cultural flows	"Water entitlements that are legally and beneficially owned by Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right". This definition was developed by representatives from thirty-one Aboriginal Nations at a joint meeting of the Murray Lower Darling River Indigenous Nations and adopted by the Northern Basin Aboriginal Nations -The Echuca Declaration, September 2010 (MLDRIN 2007).
Environmental flows	Environmental flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and wellbeing that depend on these ecosystems.
Nation	An aggregate of people that are united by a shared descent, culture and/or language and who inhabit a particular state or territory and who have a shared body of law and custom.
Traditional Aboriginal Knowledge	DN: Traditional Aboriginal knowledge includes the cultural traditions, values, beliefs, and worldviews of Aboriginal peoples as distinguished from Western scientific knowledge. Traditional Knowledge is cumulative and dynamic, it is based on direct experience, testing, observation of patterns over long periods of time, and teachings and recording in the collective memory through oral tradition, storytelling, ceremonies and songs. It is a holistic and inclusive form of knowledge." (adapted from Dei 1993:105; Augustine n.d.)
Traditional Owner	The Aboriginal person or people who possess rights, interests and responsibilities for an area of Country. These rights, interests and responsibilities are defined by traditional law and custom and are also handed down through this customary law. Traditional Owners are recognised as having a primary interest in the land and their existence is not contingent on recognition of such under white law.
Western Science	The systematic study of the nature and behaviour of the material and physical universe originating in European enlightenment. This system of knowledge is based on observation, experiment, and measurement, and the formulation of laws to describe these facts in general terms.

ECOLOGICAL TERMS

Aquatic ecosystem	Ecosystems that depend on flows, or periodic or sustained inundation/ waterlogging for their ecological integrity (e.g. wetlands, rivers, karst and other groundwater-dependent ecosystems, saltmarshes and estuaries) but do not generally include marine waters (defined as areas of marine water the depth of which at low tide exceeds six meters, but to be interpreted by jurisdictions). See also ecosystem
Assessment (wetland)	The identification of the status of, and threats to, wetlands as a basis for the collection of more specific information through monitoring activities. See also condition and condition assessment
Benefits	Benefits/services are defined in accordance with the Millennium Ecosystem Assessment definition of ecosystem services as "the benefits that people receive from ecosystems (Ramsar Convention 2005a), Resolution IX.1 Annex A). See also "Ecosystem Services".
Biodiversity	Biodiversity, or biological diversity, means the variety of life or variety of living things; and living things means plants, and animals, and microbes, and fungi, their DNA, and ecosystems. Biodiversity, in the full sense of the term, is not monitored and is not readily quantified.
Biota	The animal and plant life of a particular region or habitat.
Conceptual model	Conceptual models can take a number of forms. They are often defined as a type of diagram which shows of a set of relationships between factors that are believed to impact or lead to a target condition; a diagram that defines theoretical entities, objects, or conditions of a system and the relationships between them. In the context of this project conceptual models will illustrate the response of cultural and ecological values to the delivery of cultural flows.
Condition (ecosystem, vegetation, community, species)	The state or health of individual animals or plants, communities or ecosystems. Condition of an ecosystem, vegetation type, ecological community or species describes whether, and how much, it differs from an unimpacted or reference state. Condition can be described using a number of attributes. For example in assessing vegetation condition, the most commonly-used attributes are abundance or extent, vegetation structural features, species composition, nativeness, age structure and vigour. Condition is referential, meaning the vegetation attributes at a site are compared to a reference condition or benchmark or ideal state for that site. In the case of a species, typically a tree, or a stand of trees, condition means vigour, and condition describes how vigorous the canopy appears to be. Condition is based on observations of the canopy such as canopy cover, foliage density, and extent of dieback.
Condition assessment	A means to assess long-term changes in natural conditions and to assess long-term changes resulting from widespread anthropogenic activity.
Diversity	Diversity is the number of entities in a sample and the evenness of their abundance; in the case of species diversity, number and evenness are combined into a single value, using a diversity index. Most often diversity means species diversity, but other types of diversity can be described and reported on such as structural diversity, community diversity, genetic diversity and functional diversity in ecological studies: in these cases, 'diversity' is used rather loosely to mean variability, with no standard quantitative measures. The term 'biodiversity' is not the same as species diversity and has it has its own meaning.

Ecological character	The combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time. [Within this context, ecosystem benefits are defined in accordance with the MA definition of ecosystem services as "the benefits that people receive from ecosystems".] (Resolution IX.1 Annex A) (Ramsar 2012).
Ecological community	An assemblage of organisms characterised by a distinctive combination of species occupying a common environment and interacting with one another (ANZECC and ARMCANZ 2000).
Ecosystems	The complex of living communities (including human communities) and non-living environment (Ecosystem Components) interacting (through Ecological Processes) as a functional unit which provides inter alia a variety of benefits to people (Ecosystem Services) (Millennium Ecosystem Assessment 2005).
Ecosystem components	Include the physical, chemical and biological parts of a wetland.
Ecosystem processes	Are changes or reactions which occur naturally within wetland ecosystems. They may be physical, chemical or biological. This equates to process such as carbon cycling, denitrification, acidification, sedimentation, migration, breeding, reproduction, etc.
Ecosystem functions	Are activities or actions which occur naturally in wetlands as a product of the interactions between the ecosystem structure and processes. Functions as defined by Ramsar include flood water control; nutrient, sediment and contaminant retention; food web support; shoreline stabilisation and erosion controls; storm protection; and stabilisation of local climatic conditions, particularly rainfall and temperature.
Ecosystem services	The benefits that people receive or obtain from an ecosystem. The components of ecosystem services are provisioning (for example food and water), regulating (for example flood control), cultural (for example spiritual, recreational), and supporting (for example nutrient cycling, ecological value). (Millennium Ecosystem Assessment 2005). See also "Benefits"
Geomorphology	The study of the evolution and configuration of landforms.
Goal	A goal is a concise, general statement of the overall purpose of a program. For example: "To ensure that environmental water allocations provide the greatest ecological benefits to receiving waterbodies" or "To manage wetlands to provide habitat for breeding migratory birds".
Indicator (ecological)	Refers to representative, measurable parameter which conveys useful information concerning ecosystem condition. These can be physico-chemical and/or biological.
Intervention	A management activity that seeks to change an ecosystem's state or condition and achieve a management objective. In this case the intervention is the delivery of a cultural flow. See also intervention monitoring.
Intervention monitoring	Supports the evaluation of management interventions by quantifying the response to specific management interventions.
Inventory (wetland)	The collection and/or collation of core information for wetland management, including the provision of an information base for specific assessment and monitoring activities

Monitoring (wetland)	Collection of specific information for management purposes in response to questions derived from assessment activities, and the use of these monitoring results for implementing management. (Note that the collection of time-series information that is not question-driven from wetland assessment should be termed surveillance rather than monitoring). The key aspects of an environmental monitoring program therefore are: • It is specific and hypothesis driven (i.e. it answers a specific question); • It involves the collection of information over time (i.e. multiple sampling events); and • It is used to inform ecosystem management.
Richness	Richness is the number recorded. It is most commonly used to refer to species, as in species richness. See: species richness
Species richness	Species richness is the number of species recorded, for example, in a sample. Species richness is sensitive to sampling effort (number of quadrats, size of quadrats, total area sampled).

HYDROLOGICAL AND HYDRAULIC TERMS

Dimensions (number of) modelled (in numerical hydraulic modelling)	Hydraulic models can be classified into 1D, 2D and 3D, where D means dimension. The dimension referred to here is space. • 1D model represents flow properties (depth and velocity) only in the longitudinal (downstream, X) direction. Such models are usually used to predict velocity averaged across the transversal (width, Y) and vertical (depth, Z) dimensions ofa cross-section. • 2D model represents flow properties along either the longitudinal (X) and transversal (X) directions, or the longitudinal (X) and vertical (Z) directions. Such models are usually used to predict the depth and magnitude and direction (X, Y) of mean vertical velocity at points. • 3D model represents the depth and magnitude, direction, and vertical distribution (X, Y, Z) of velocity at points. Due to the computation time, difficulty in model set-up, uncertainty of results, and inability to characterise project objectives in 3D, such models are normally used only in research applications, or in small areas. 1D models provide a reliable representation of the hydraulic conditions in river channels, while 2D models can represent the hydraulic conditions on floodplain surfaces. Most river-floodplain situations involve both of these conditions, so a linked 1D-2D model is appropriate.
Fluvial geomorphology	The study of landforms shape (morphology) and processes associated with flowing water. The morphology of a channel or wetland influences the distribution of hydraulic conditions (depth, extent, velocity). Over time, as the site is subjected to flow events (either naturally or artificially generated events), the morphology can be expected to change. Fluvial geomorphology might be relevant in the context of a cultural flows assessment, depending on the site characteristics and the objectives.
Hydraulic	Certain physical characteristics of, usually, moving water. In this report the characteristics of interest are rate of flow, or velocity (m/s), depth of water from the bed or ground (m), direction of flow (bearing in degrees), bed shear stress, or force acting on the bed (N/m^2), volume of water within a bounded area (m^3), area of water within a bounded area (m^2), and location of water (defined by geographical coordinates).
Hydraulic model	There are practical limitations to measuring hydraulic variables. A hydraulic model describes the relationship between the spatial distribution of a hydraulic variable (such as water depth and presence) and river hydrology, or artificial flow delivery. The relationship can be developed using an empirical or numerical modelling approach.
Hydraulic model (empirical)	Developed from multiple observations of water extent measured using satellite imagery, aerial photography, a sensor on a low-altitude UAV (unmanned aerial vehicle), or on ground survey and water flow in the river, or flow pumped or diverted to the site, measured at the same time. With enough data points, the relationship will provide a sufficiently reliable prediction of the maximum extent of inundation that can be expected for given river flow conditions, or given inflows to the site. The distribution of water depth for any given water extent can be predicted if the topography of the site has been characterised, by LiDAR or ground survey. Provided input data are available, empirical models are relatively inexpensive to develop.

Hydraulic model (numerical)	Predicts water extent, flow rate, and flow direction, on the basis of good quality topographic data obtained by LiDAR or ground survey and well-known equations that describe the physics of water flow. Numerical models are uncertain, and require calibration against empirical data from observed flow events to provide reliable predictions. Due to high data demands, high level of spatial and temporal resolution, high data processing demands, and high-level technical modelling skills required, numerical hydraulic models are expensive to develop and expensive to run.
Hydrological	Having characteristics related to the water cycle and its individual components. In this report, it usually refers to the temporal (over time) pattern of water flow (ML/d), water level from a datum (m), water extent (ha or m^2), rainfall (mm), seepage (mm), evapotranspiration (mm or ML). The flow could be in a river, or into and out of a floodplain wetland, of cultural interest.
Hydrological component (of a wetland water regime)	The main elements of a wetland water regime, comprising Dry period, Constant level, Small inundation event, Moderate inundation event and Large inundation event.
Hydrological event	A hydrological phenomenon of relevance to cultural water needs. An event could be a period of no water, stable water level or flow, or a rise and fall in water levels in a river of wetland.
Hydrological model	Can overcome practical limitations to measuring hydrological variables. A hydrological model predicts how much water will be present in a river or wetland at any time. It relates rainfall, evapotranspiration and seepage through time using mathematical algorithms that describe fundamental physical processes. Two common types of model are rainfall-runoff model (predicts river flow from rainfall), and wetland water balance model.
Hydrological time series	Basic hydrological data concerning events, and long term hydrology are time series and can be plotted as a simple line-chart showing the observed value over time. Normally these data are simplified using statistics to characterise central tendency, dispersion, frequency, duration, and rates of change.
Scenario (in hydrological modelling)	A set of conditions that apply to the input data of a hydrological model, usually simulating a current, future or past condition, such as climate change, pre-water resources development, or with cultural flows.
Time scale (long-term hydrological)	In the order of 50 – 100 years, which is long enough to characterise the likelihood of hydrological events of cultural interest occurring in the future, under assumed conditions.
Time-scale (event)	In the order of days weeks or months.
Water balance model (wetland)	Operates at the scale of an individual wetland to predict the water level and extent of inundation over time. Can be used to predict wetland water level and extent over the long-term scale.

Water loss	In a waterbody such as a floodplain wetland, water loss incurred through evapotranspiration and seepage to the ground (which is later lost to evaporation or transferred to neighbouring hydrological system).
Water quality	The collective physical and chemical properties of water that are usually assessed relative to tolerable and preferred ranges specific to the use of the water or waterbody, including by aquatic organisms. Water quality is commonly investigated using historical data from established monitoring programs, and can also be predicted using a coupled hydrology-water quality model. Water quality might be relevant in the context of a cultural flows assessment, depending on the site characteristics and the objectives.
Water resource model	Hydrological models can operate at a large scale. For management of water resources of large areas, whole of catchment models are used, such as eWater Source catchments, MSM_Bigmod (predicts the flow in the River Murray), REALM (often used in Victoria) and IQQM (often used in Queensland and NSW). These hydrological models also contain some *hydraulic* components, to explain how certain characteristics of flow are modified through time and movement. Such models also have water quality prediction capability.
Water use	Refers to how much water is used over time through events, either natural or controlled (managed) events, such as delivering water to satisfy cultural water needs. In this context, water use means the difference between the water that was available for use at the beginning of the event, and how much is available after the event.
Water year	A period of 12 months over which annual hydrological statistics are calculated and water accounting and management are conducted. The start of the water year depends on the seasonality of the river and is usually within the low flow period. For the Murray-Darling Basin, the conventional water year is July to June, such that each irrigation season belongs entirely within one year, and it avoids splitting summer flood events originating in the northern Basin into separate years.

KEY ACRONYMS AND ABBREVIATIONS

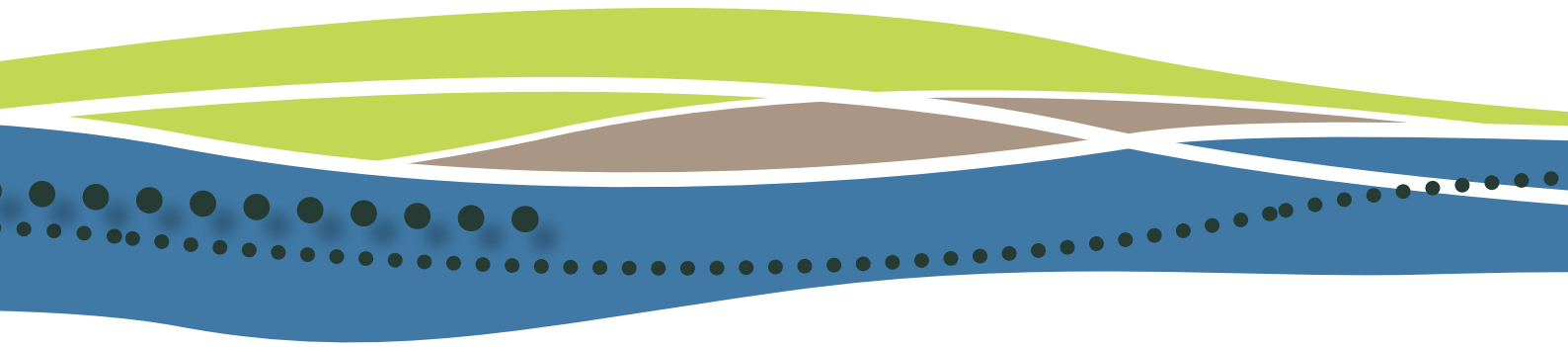
CEWH	Commonwealth Environment Water Holder
CFMP	Cultural Flow Management Plan
CECD	Cultural and Ecological Character Description
FPIC	Free, Prior and Informed Consent
IP	Intellectual Property
IPA	Indigenous Protected Area
KEQ	Key Evaluation Questions
NCFWG	Nation Cultural Flow Working Group
MDBA	Murray Darling Basin Authority
MER	Monitoring, Evaluation and Review
MERI	Monitoring, Evaluation, Reporting and Implementation
MLDRIN	Murray Lower Darling Rivers Indigenous Nations
MNDWI	Modified Normalised Difference Water Index
NAILSMA	North Australian Indigenous Land and Sea Management Alliance
NBAN	Northern Basin Aboriginal Nations
NCFRP	National Cultural Flows Research Project
NEP	Nation Engagement Plan
NNTC	National Native Title Council
NSW	New South Wales
PAR	Participatory Action Research
RSSA	Rural Solutions SA
SMART	Specific, Measurable, Achievable, Resourced and Time-bound

PHOTOGRAPHS

Cover	Horseshoe Bend on the Wimmera River – Will Mooney, courtesy MLDRIN
Page 2-3	Toogimbie Wetlands – Jamie Woods, courtesy Nari Nari Tribal Council
Page 8	Banrock Station Wetlands – Arthur Mostead, courtesy MDBA
Page 12	Culgoa River – Tamarind Meara, courtesy Murrawarri Provisional Council of State
Page 16	Barwon River, Brewarinna – Arthur Mostead, courtesy MDBA
Pages 21-21	Kinnairds Swamp – Arthur Mostead, courtesy MDBA
Page 26	Toogimbie Wetlands – courtesy Nari Nari Tribal Council
Page 31	Nari Nari Cultural Flows Research Team at Toogimbie Wetlands – courtesy Nari Nari Tribal Council
Pages 32-33	Toogimbie Wetlands – Alanna Maguire, courtesy Nari Nari Tribal Council
Page 37	Wetlands in the northern Basin – Marnie Ireland, courtesy NNTC
Pages 44-45	Reedy Swamp – Arthur Mostead, courtesy MDBA
Page 49	Barapa Barapa Traditional Owners, North Central CMA staff and MLDRIN facilitators at Black Swamp in the Gunbower Forest – Will Mooney, courtesy MLDRIN
Page 50	Toogimbie Wetlands, an oasis in a dry landscape – Jamie Woods, courtesy Nari Nari Tribal Council
Page 51	Scar tree at Gooraman Swamp – Tamarind Meara, courtesy Murrawarri Provisional Council of State
Pages 52-53	Gurra Gurra Creek, SA – Arthur Mostead, courtesy MDBA
Pages 56-57	Toogimbie Wetlands – Alanna Maguire, courtesy Nari Nari Tribal Council

Cultural flows are water entitlements that are legally and beneficially owned by the Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Nations. This is our inherent right.

Echuca Declaration, 2010



IndigenousNations

NAILSMA North Australian Indigenous Land & Sea Management Alliance

Northern Murray–Darling Basin Aboriginal Nations